

Installing PC-NFS

A Guide to the User and System Administrator

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PC-NFS 3.0.1
Release Notes

(Part No. 814-3007-05; Rev. B)

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Introduction

New with Release 3.0.1

PC-NFS 3.0.1 has these new features:

- Serial Line Internet Protocol (SLIP) server support for SunOS™ 4.0
- Support for DOS 4.0
- The *PC-NFS Serial Communications Guide*

Change pages. The 3.0.1 release also includes software fixes and changes to the documentation. Change Pages for *Installing PC-NFS, A Guide to the User and System Administrator* and the *PC-NFS User's Manual* and instructions for inserting them are packaged with these Release Notes (unless you ordered a software-only kit).

SLIP Guide. Use the new *PC-NFS Serial Communications Guide* for information on installing and using PC-NFS on SLIP connections. If you installed the SLIP server software from PC-NFS 3.0, you should reinstall SLIP using the PC-NFS 3.0.1 kit, and should read Chapters 2 and 3 of the *PC-NFS Serial Communications Guide* for information on changes from the previous release.

3.0.1 Upgrade Kits

Sun's Customer Service Division offers site-wide upgrades for pre-3.0.1 installations. For more information, see the section "PC-NFS Telemarketing HotLine" at the end of these Release Notes.

Check Your Kit

Check the contents of your kit as soon as you receive it to verify that you have received all of the items you purchased. The following paragraphs list the items that should be contained in each type of PC-NFS™ kit. If anything is missing, please call the Sun Support Hotline at (800) USA-4SUN.

Hardware/Software Kit: If you purchased the hardware/software kit (PC-NFS-3C-51 or PC-NFS-3C-51M), you should receive the following items:

- Documentation:
  - The *PC-NFS 3.0.1 Release Notes*
  - Change Pages
  - *Installing PC-NFS, A Guide to the User and System Administrator* and the *PC-NFS User's Manual*, with binder and slip case
  - The *PC-NFS Serial Communications Guide*
- An envelope containing seven 5-1/4 inch PC-NFS distribution diskettes, or four 3-1/2 inch PC-NFS distribution diskettes
- A 3C503 or 3C523 3Com® Ethernet® card (optional)
- The 3Com 3C503 or 3C523 *Installation Manual* (optional)
- The 3Com 3C503 or 3C523 Diagnostics Diskette (optional)

Software/Documentation Kit: If you purchased the software/documentation kit (PC-NFS-51 or PC-NFS-51M) you should receive the following items:

- Documentation:
  - The *PC-NFS 3.0.1 Release Notes*
  - Change Pages
  - *Installing PC-NFS, A Guide to the User and System Administrator* and the *PC-NFS User's Manual*, with binder and slip case
  - The *PC-NFS Serial Communications Guide*
- An envelope containing seven 5-1/4 inch PC-NFS distribution diskettes, or, four 3-1/2 inch PC-NFS distribution diskettes

Software-only Kit: If you purchased the software-only kit (PC-NFS-56 or PC-NFS-56M) you should receive the following items:

- The *PC-NFS 3.0.1 Release Notes*
- An envelope containing seven 5-1/4 inch PC-NFS distribution diskettes, or four 3-1/2 inch PC-NFS distribution diskettes

Documentation-only Kit: If you purchased the documentation-only kit (PC-NFS-09) you should receive the following items:

- The *PC-NFS 3.0.1 Release Notes*
- Change Pages
- *Installing PC-NFS, A Guide to the User and System Administrator* and the *PC-NFS User's Manual*, with binder and slip case
- The *PC-NFS Serial Communications Guide*

Upgrade Kit: There are two versions of the PC-NFS upgrade kit:

- 3.0 to 3.0.1 upgrade kit (PC-NFS-3.0.1-51UP)
- Pre-3.0 to 3.0.1 upgrade kit (PC-NFS-3.0.1-51UF)

If you purchased an upgrade kit, you should receive the following items:

3.0 to 3.0.1 upgrade kit (PC-NFS-3.0.1-51UP):

- The *PC-NFS 3.0.1 Release Notes*
- Change Pages
- The *PC-NFS Serial Communications Guide*
- An envelope containing seven 5-1/4 inch PC-NFS distribution diskettes, and four 3-1/2 inch PC-NFS distribution diskettes

Pre 3.0 to 3.0.1 upgrade kit (PC-NFS-3.0.1-51UF):

- The *PC-NFS 3.0.1 Release Notes*
- Change Pages
- *Installing PC-NFS, A Guide to the User and System Administrator* and the *PC-NFS User's Manual*, with binder and slip case
- The *PC-NFS Serial Communications Guide*
- An envelope containing seven 5-1/4 inch PC-NFS distribution diskettes, and four 3-1/2 inch PC-NFS distribution diskettes

If you are upgrading from PC-NFS 3.0 to 3.0.1, take the *Read This First* document out of your documentation binder and replace it with these 3.0.1 Release Notes.

If you are upgrading from 1.0 or 2.0, your new documentation does not include a copy of the Read This First document. In this case, place these 3.0.1 Release Notes in the front of the binder.

Before You Install PC-NFS

Before you install PC-NFS, please read the rest of these Release Notes, and then refer to *Installing PC-NFS, a Guide to the User and System Administrator.*

Read the License before Opening the Envelope

Before opening the diskette envelope or the PC-NFS documentation, please read the license agreement printed on the envelope. If you cannot accept the terms of this agreement, you should return the kit to your Sun salesperson. By opening the diskette envelope, you acknowledge that you have read the agreement and accept the terms and conditions printed on it.

Send in Your User Registration Card

It is very important to fill out and send in the registration card that accompanies your PC-NFS diskettes. The address that you provide on this card allows Sun to notify you of PC-NFS updates.

Back Up Your Diskettes

Back up the distribution diskettes before you install PC-NFS. As with any diskette release, the prudent course is to have a backup copy of the software as well as the original copy.

Diskette Contents

The following sections list the contents of the seven 5-1/4 inch PC-NFS distribution diskettes:

- PC-NFS Installation Diskette
- PC-NFS Connections Diskette
- PC-NFS Configuration Diskette
- PC-NFS Utilities Diskette
- PC-NFS Network Diskette
- PC-NFS Server 1 Diskette
- PC-NFS Server 2 Diskette

The 3-1/2 inch diskettes contain the same files. However, the 3-1/2 inch diskettes combine the contents of the 5-1/4 inch diskettes as follows:

- PC-NFS Installation and Connections Diskette
- PC-NFS Configuration and Utilities Diskette
- PC-NFS Network Diskette
- PC-NFS Server 1 and Server 2 Diskette

PC-NFS Installation Diskette

`PCNFS.SYS`	PC-NFS device driver
`KIT1.TXT`	Files to be copied during installation
`FOKIT1.TXT`	Files to be copied during installation on a diskette-only system
`INSTALL.EXE`	Installation program
`INSTALL.TXT`	Help and error text for `INSTALL.EXE`
`INSTALL.NDX`	Index file for `INSTALL.TXT`
`PRT.EXE`	Printer redirector
`NET.EXE`	Net command
`DOS2UNIX.EXE`	DOS to UNIX® file format conversion
`UNIX2DOS.EXE`	UNIX to DOS file format conversion

PC-NFS Connections Diskette

KIT2.TXT	Files to be copied during installation
FOKIT2.TXT	Files to be copied during installation on a diskette-only system
3C501.SYS	3Com 3C501 device driver
IPCME.SYS	Memory device driver for use with SunIPC™
NIC.SYS	Ungermann-Bass NIC device driver
NI5010.SYS	Micom Interlan® NI5010 device driver
SOCKDRV.SYS	Socket device driver
3C505.SYS	3Com 3C505 device driver
3C505DX.SYS	3Com 3C505 on-board (downloaded) device driver
WD8003E.SYS	Western Digital WD8003E device driver
SLIP.SYS	Serial Line IP device driver
NFSVEC.SYS	3Com 3C503 and 3C523 device driver
ETHVEC.SYS	3Com Ethernet driver for use with 3+
VECIE3.SYS	3Com hardware interface driver for 3C505
VEC523.SYS	3Com hardware interface driver for 3C523
VECIE6.SYS	3Com hardware interface driver for 3C503
PSH.SYS	3Com pusher device driver for 3C505
PROA.SYS	3Com process manager device driver for 3C505
LDR.EXE	3Com loader for intelligent boards
LDR.CFG	3Com configuration file for LDR.EXE
TELNET.EXE	Terminal emulator
EMTELNET.EXE	Part of the TELNET terminal emulator
EM.COM	Part of the TELNET terminal emulator
EM_MSG.TXT	TELNET message file
NFSRUN.EXE	PC-NFS startup utility

PC-NFS Configuration Diskette

KIT3.TXT	Files to be copied during installation
FOKIT3.TXT	Files to be copied during installation on a diskette-only system
NFSCONF.EXE	PC-NFS configuration command
NFSCONF.TXT	Help and error text for NFSCONF.EXE
NFSCONF.NDX	Index file for NFSCONF.TXT
ETHERS	Ethernet database for systems without Yellow Pages
NETGROUP	Group database for systems without Yellow Pages
NETWORKS	Network database for systems without Yellow Pages
PASSWD	User name and password database for systems without Yellow Pages
PROTOS	Protocol database for systems without Yellow Pages

RPC	Remote Procedure Call database for systems without Yellow Pages
SERVICES	Services database for systems without Yellow Pages
PCNFS.MSG	File containing the PC-NFS messages
MV.EXE	File rename command
MYEADDR.EXE	Display Ethernet address command

PC-NFS Utilities Diskette

KIT4.TXT	List of files copied during installation
ARP.EXE	Address Resolution Protocol command
FTP.EXE	File Transfer command
RCP.EXE	Remote File Copy command
RSH.EXE	Remote Shell command
CONNECT.EXE	Connect PC-NFS through a modem
HANGUP.EXE	Disconnect PC-NFS from a modem

PC-NFS Network Diskette

KIT5.TXT	List of files copied during installation
NETSTAT.EXE	Network Statistics command
SHOWMNT.EXE	Show mounted file systems command
YPCAT.EXE	Display Yellow Pages database command
YPMATCH.EXE	Display Yellow Pages database entry command
LS.EXE	Display file information command
CHMOD.EXE	Change NFS file protection command
NFSPING.EXE	Determine if a system is an NFS server
NFSSTAT.EXE	Display NFS statistics
RPCINFO.EXE	Display Remote Procedure Call information

PC-NFS Server 1 Diskette

R_PCNFSD.C	PC-NFS daemon source (`rpc.pcnfsd.c`)
ADPCNFSD.CSH	UNIX C-Shell script for installing `rpc.pcnfsd`
R_LOCKD	Sun-2™and Sun-3™ lock daemon
MAKEFILE	For making `rpc.pcnfsd`

PC-NFS Server 2 Diskette

R_LOCKD.S4	Lock daemon for the Sun-4™
SERIAL\MAKEFILE	For unpacking `slipdist.tar`
SERIAL\SLIPDIST.TAR	Serial Line IP distribution for Sun-2 and Sun-3
SERIAL\SLIPDST4.TAR	`slipdist.tar` for the Sun-4
SERIAL\SLIPD40.TAR	`slipdist.tar` for SunOS 4.x

SERIAL\SLIPDIST.TAR contains the following UNIX format files for use on a SunOS 3.x SLIP server:

SLIPDIST/ADDSLIP.CSH	UNIX C-Shell script for installing SLIP
SLIPDIST/H/IOCTL.H	Replacement ioctl.h
SLIPDIST/SUNIF/IF_SL.C	Serial Line IP driver
SLIPDIST/SYS/TTY_CONF.C	Replacement for tty_conf.c
SLIPDIST/USR/DSLIPUSER.C	Utility to display information on all current dialup SLIP users
SLIPDIST/USR/MKSLIPUSER.C	Utility to initialize dialup SLIP user table
SLIPDIST/USR/SLATTACH.C	Utility to assign a tty line for SLIP
SLIPDIST/USR/SUNSLIP.C	Utility to allocate a dialup line on a per session basis
SLIPDIST/USR/SLIP.H	Include file for these utilities

SERIAL\SLIPDST4.TAR and **SERIAL\SLIPD40.TAR** contain analogous programs for the Sun-4 (with SYS4/3.2) and for SunOS 4.x, respectively.

Not Included

PC-NFS 3.0.1 does not include the utilities:

REBOOT.COM and LPCONFIG.EXE	These utilities were part of PC-NFS 1.0 and 2.0. However, they do work under PC-NFS 3.0.1, and nfsconf uses printer configurations created with LPCONFIG.EXE.
NIU.SYS	NIU.SYS is a driver for a board that is no longer supported in PC-NFS 3.0.1.
PUTMSG and GETMSG	These utilities are used to alter error messages. If you need these utilities, contact your Sun Salesperson.
R_STATD	This file is no longer included because PC-NFS 3.0.1 does not support locking on SunOS versions less than 3.2.

Not Supported in Release 3.0.1

NIU. PC-NFS 3.0 was intended to support the NIU Ethernet controller using the then unreleased Ungermann-Bass Net/One XNS Release 16. A number of customers were able to use this software combination. However, due to incompatibilities in PC-NFS and Net/One releases, a number of difficulties were reported. To remedy this situation, NIU is now supported using a driver available from Ungermann-Bass. Contact your local Ungermann-Bass representative for information.

If you were successful in using Net/One XNS Release 16 and the PC-NFS 3.0 NIU driver and want to continue using this software combination, you should:

1. Save the PC-NFS `NIU.SYS` file, `AUTOEXEC.BAT` file and `CONFIG.SYS` file with `.OLD` extensions before you upgrade to PC-NFS 3.0.1.

2. After upgrading to 3.0.1, restore the files to their original names.

OS/2™ DOS compatibility box. PC-NFS 3.0.1 does not run in the OS/2 DOS compatibility box.

3Com Coexistence. Coexistence with 3Com 3+ is not supported in PC-NFS 3.0.1 Sun is working with 3Com to address this issue. If 3+ coexistence is required for your PC-NFS installation, please call 1-800-USA-4SUN, or send e-mail to ...sun!hotline to receive up-to-date information.

Locking support on Sun-2 systems. PC-NFS 3.0.1 does not provide locking support for Sun-2 systems.

Enhancements and Bugs Fixed in Release 3.0

This section contains a list of bugs and other problems corrected in PC-NFS 3.0. The numbers indicate a customer problem report.

1002842 - Use of the mode commands in PC-NFS 3.0 does not affect printing.

1003600 - PC-NFS is now compatible with 4.2BSD and 4.3BSD `telnetd`.

1004992 - PC-NFS 3.0 supports many new time zones, including Hawaiian. You can enter any time zone using `nfsconf`; however, PC-NFS does not check to see if the time zone you enter is legitimate.

1005003 - The `dos2unix` command using redirection now works correctly.

1005092 - Attempting to update a bootable diskette from PC-NFS 1.00 to PC-NFS 2.0 failed. Upgrading from PC-NFS 1.0 or PC-NFS 2.0 to PC-NFS 3.0 works correctly.

1006523 - PC host names greater than 15 characters no longer overwrite the network address. However, PC-NFS only supports host names of up to 15 characters.

1006839 - PC-NFS 3.00 supports the MS-DOS® 3.3 `BACKUP` utility.

1006967 - PC-NFS 3.00 correctly emulates the DOS function 27. Applications such as `vedit` no longer lose the last block of their files.

1007046 - The install program for PC-NFS 2.0 did not distinguish between certain PC compatibles and the SunIPC. The `install` program for PC-NFS 3.0 asks you to verify the use of a SunIPC.

Enhancements and Bugs Fixed in Release 3.0.1

This section contains a list of bugs and other problems corrected in PC-NFS 3.0.1. Items with bug numbers assigned to them as a result of customer problem reports are listed first.

1004354 - PC-NFS supports multiple user groups. Prior to PC-NFS 3.0.1, a user who logged in with **net name** was only registered as a member of the base group found in the `passwd` database. In 3.0.1, the `group` YP map is also consulted to determine membership in up to eight other groups. Note that for security reasons multiple groups are only supported under Yellow Pages. You *cannot* use a local \NFS\GROUP file.

1007044 - The size of the FTP file list buffer has been increased. Users can now FTP `mput` more than a few files.

1008722 - PC-NFS `telnet` VT-100® emulation correctly handles illegal VT-100 escape sequences. A VT-100 ignores illegal escape sequences.

1010880 - PC-NFS correctly follows symbolic links, including a link target that is not a legal DOS name.

1013668 - PC-NFS `rsh` does not read your `.profile` on a remote system when that system's `passwd` file specifies the Bourne shell as your default shell. In this case, PC-NFS `rsh` uses the default path instead of the one set in your `.profile`. You must type a command's full path name to execute it on the remote machine, unless it is within the default path.

- SLIP direct connect links now operate correctly at speeds of 1200 baud to 9600 baud.

- Setting a printer hot key no longer hangs certain types of PCs. In addition, the hot-key setting is no longer lost when you reboot.

- Changes in the print redirector sequencing and error handling mean that print data is no longer lost or prematurely spooled.

- Any attempt to issue a directory search on a plain file is now trapped correctly. Previously this could cause server crashes.

- Creating temporary files and file locking with Nantucket Corporation's Clipper™ now work correctly.

- Support has been added for the networked versions of dBASE III Plus® and FoxBASE™.

- When renaming a file in Microsoft Editor®, the new name is processed correctly to transform it from DOS to NFS format.

- Prior to PC-NFS 3.0.1, `telnet` used a hard-coded port number. It now consults the `services` YP map or file to determine the port to be used.

- PC-NFS `telnet` can now be configured to send CR-LF or CR-NULL when the Return key is pressed. The default remains CR-NULL.

- If a `telnet` host crashes, the reconnect option no longer causes `telnet` to hang until the host comes back up.

- Prior to PC-NFS 3.0.1, if a printer was redirected to a lightly loaded server and the PC was rebooted twice in quick succession, the server could incorrectly reject certain NFS requests as duplicates. This has been fixed.

- PC-NFS now handles ICMP Redirect requests correctly. A Redirect causes PC-NFS to select the indicated gateway as the new default gateway.

- Prior to PC-NFS 3.0.1, RPC broadcasts on subnetted networks could fail, usually because of an inability to locate a YP server using **`net ypset *`**. This problem has been fixed for all applications, including those developed with the PC-NFS Programmer's Toolkit.

- PC-NFS FTP strips any DOS control-Z EOF character appended to text files on `put`.

- The `chmod` command now handles multiple files correctly.

- PostScript® and standard text data streams containing certain control characters, which can disrupt spooled printing, are now filtered to remove these characters. There is also a new Raw printing mode for cases where control characters should not be filtered.

- SLIP to SunOS 3.x no longer requires `/etc/gateway` files to be maintained. Routing information is determined dynamically.

- PC-NFS now supports the DOS `5F02` call (Get Redirection List), which allows application programs to determine which drives and printers are redirected. (The other `5F` calls are not supported.)

- PC-NFS now supports 8-bit international character sets for file names, which includes most European character sets. Note that utilities such as `telnet` still only support 7-bit ASCII.

- PC-NFS now supports execute only files. If you have execute only access to a `.EXE` or `.COM` file, you can execute it, but you cannot read or copy it. Not all applications are compatible with this feature, particularly those using overlays or copy protections.

- The idle time out for print spooling, formerly fixed at five minutes, is now configurable.

- Previously, Framework III, version 1.1, did not recognize PC-NFS mounted network drives. When you mounted a drive using PC-NFS, the drive disappeared from the available drive listing. This problem has been corrected.

- PC-NFS now accepts a Yellow Pages domain name of up to 120 characters. The previous limit was fifteen characters.

Notes

The Sun386i™ System and Printing. You are not required to install `pcnfsd` on a Sun386i system running SunOS 4.0.1; it is pre-installed for you. Note that on the Sun386i server, the spool directory is exported as `/export/spool/pcnfs -access=domain`. This allows only PC-NFS users who are in this YP domain to mount the remote printer.

DOS 4.0 DOSSHELL. The IBM® DOS 4.0 DOSSHELL file management subsystem does not work on drives that contain more than a certain number of files. Though it is more likely that a network drive will go over this limit than a local drive will, the limitation is one of DOSSHELL and not of PC-NFS.

In some cases, a workaround is to mount a subdirectory that has fewer than the maximum files. In other cases, the workaround is not to use the DOS-SHELL file manager with these drives.

DOS 4.0 and Diskette-only Installation. If you are using a diskette-only PC running DOS 4.0, you can install PC-NFS on any diskette with a capacity greater than or equal to 720 Kbytes. You cannot install PC-NFS on a diskette with a storage capacity of 360 Kbytes because of the amount of space needed by DOS.

Olivetti® M-24 (AT&T 6300) PCs. Using PC-NFS with a 3C503 Ethernet card on an early version of either the Olivetti M-24 or AT&T 6300 PC may cause problems with certain TCP-based services, such as `telnet`. You may need a BIOS upgrade to establish a TCP connection. The BIOS upgrades should be obtained directly from the manufacturer.

DOS 3.1 or above is required for all TCP based services: `telnet`, `rsh`, `rcp`, `ftp`, and for all TCP-based PC-NFS Toolkit applications.

If you do not have Yellow Pages, you need to add host names and IP addresses to the `\NFS\HOSTS` file so that you can use `ftp`, `telnet`, `rsh` and `rcp`.

Locking and "sharing" files with oneself. If you open the same file twice within the same application, PC-NFS file locking and sharing does not recognize you as the same user and denies you access to files you have locked.

Color versus monochrome. The PC-NFS installation program and `nfsconf` are designed to take advantage of color and monochrome monitors. However, monitors vary widely. If you experience difficulty reading the screen displays, reinstall PC-NFS choosing the option you did not chose in the original installation. That is, if you chose monochrome, but are having difficulty reading the screens, restart the installation and select color.

Exiting to DOS. On some computers (notably the Leading Edge Model D®) and the SunIPC, when you exit `nfsconf` using the Ctrl Break keys, the screen goes blank. To reset the display, type `CLS`, or issue a `MODE` command.

Changing Ethernet Boards. If you change Ethernet boards, change your configuration using `nfsconf` *before* you physically change boards.

Duplicate entries. Sometimes configuration changes you make using `nfsconf` result in duplicate entries in your `\NFS\HOSTS` file. This does not cause any problem, but you may remove duplicate host entries from your `HOSTS` file. PC-NFS reads only the first occurrence in the file.

Telnet on the IBM PS/Model 30. If you run `telnet` on a PS/Model 30 using a 3C503 board, the interaction between the card and the PC/Model 30 BIOS may cause your system to hang if you do the following:

- `Telnet` to a UNIX system.
- Run the `vi` editor and press the right arrow key repeatedly, until the cursor moves beyond the end of the line.
- `vi` beeps, and your system hangs.

This is less likely to happen if you increase the value for the `stacks` parameter in your CONFIG.SYS file. For example:

```
stacks=50, 128
```

To avoid this problem entirely, do not press the arrow key until the cursor moves past the end of the line, or use a different board.

Problems with very large files. You should not attempt to read files larger than 67 Mbytes from an NFS mounted file system. If you attempt to read past byte 67,108,864 (0x400000) in a file, PC-NFS will instead read the data at offset (N mod 67, 10,864).

Locking Support. You must upgrade your lock manager daemons if you are using Sun servers, unless your server is a Sun386i running SunOS 4.0.1.

SLIP and dropped packets. If the following message is displayed in the SLIP gateway's console,you may be experiencing some SLIP network problems:

```
... q full - dropping packets
   sloutput restart
```

This message may be seen with both direct and dialup SLIP connections, when the SLIP gateway is running SunOS 4.0 or greater. It is most likely to occur if you are on a fairly large network which broadcasts extensive routing information, and your SLIP connection has been idle for more than 5 minutes.

If you see this message, contact Sun's Customer Support Division at 1-800-USA-4SUN, or send e-mail to !sun!hotline to get current information about this problem.

Notes on Installing PC-NFS

Installing the 3C505. The `myeaddr` utility fails occasionally when it runs on very high performance PCs (for example, the 16 MHz Wyse® 386). If `myeaddr` returns an Ethernet address of all zeroes, reconfigure the PC to run at a lower speed and try again.

Installing the 3C523. When configuring a 3Com 3C523 board in an IBM® Personal System /2™ (PS/2) system for PC-NFS, you must configure the 3C523 board first using the software provided on the 3Com diskette before you install and configure PC-NFS. Read the documentation which accompanies the 3C523 board for the configuration instructions.

Installing PC-NFS on a SunIPC. This procedure requires gateway information. Ask your system administrator for the name and IP address of the gateway you should use when you install PC-NFS.

Sun-4 Server Issues

If you are running SunoS SYS4/3.2 on a Sun-4, we strongly urge you to upgrade to SunOS 4.0. The replacement lock manager supplied with PC-NFS 3.0 only runs on SunOS 4.0.

Introducing PC-NFS LifeLine

Enhance Your PC-NFS Network

Now available from Sun Microsystems is a powerful electronic mail and network backup Application for IBM PCs or compatibles, and PS/2s on your NFS network: PC-NFS LifeLine™.

PC-NFS LifeLine Mail lets you send and receive mail to or *from* anywhere, any time you want. Use your network to really communicate, as well as to share resources and printers. And PC-NFS LifeLine even works with networks that have non-DOS operating systems! By supporting industry standard protocols (SMTP and POP), PC-NFS LifeLine enables your DOS PC to interact fully with systems running UNIX (BSD and System V), SunOS, Ultrix®, VMS®, and, of course, DOS operating systems.

LifeLine Mail

PC-NFS LifeLine Mail is easy to configure, learn, and use. It features a simple installation utility, pull-down menus, single keystroke commands and context sensitive help. You decide when and where to get your mail — on your PC or any NFS mail server. PC-NFS LifeLine Mail works on your Ethernet LAN or over modems when you're away from your office. Once you try PC-NFS LifeLine Mail, you'll find you can't stop using it.

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PC-NFS LifeLine Backup takes the hassle out of backing up files and data that are distributed on your NFS network. With a single request, you back up your important work to a designated server, tape, or disk — regardless of its location. You can even direct your PC to back up files that are not on your local PC. PC-NFS LifeLine Backup lets you take advantage of your network storage and security, and stop worrying about catastrophic work loss on your PC.

PC-NFS Telemarketing HotLine

Expand Your PC-NFS Network

Once you see how effective PC-NFS, PC-NFS LifeLine and PC-NFS Programmer's Toolkit are, you and your colleagues will want to have more copies at your site.

- With PC-NFS on every PC, your entire team can share files, tap extensive network data and peripheral resources, and work more effectively.
- With PC-NFS LifeLine on every PC, you'll be able to communicate easily with everyone in your work group.

Easy Ordering

You can order PC-NFS products through Sun's convenient telemarketing service. The more copies you order on a single purchase order or credit card purchase, the lower your cost. Orders placed through Sun's telemarketing service are shipped in 48 hours. For more information and fast delivery of PC-NFS, PC-NFS LifeLine, and PC-NFS Programmer's Toolkit, contact Sun's PC-NFS Telemarketing Group at:

1-800-334-SUNM

This number is available for PC-NFS, PC-NFS LifeLine, and PC-NFS Programmer's Toolkit order entry in the United States. (Outside the U.S., contact your Sun representative or distributor.) See the following pages for ordering information.

Telephone Ordering Information

Before You Call 1-800-334-SUNM. Please have the following information ready when you call to order PC-NFS products:

Name and Phone: _____

Company: _____

Dept. & Mail Stop: _____

Billing Address: _____

_____

Shipping Address: _____

_____

Requisitioner: _____

Valid P.O. #: _____

Sun Sales Rep.: _____

Item	Description	Quantity
PC-NFS-51(M)*	RTU License for one PC PC-NFS software PC-NFS documentation	_____
PC-NFS-3C-51	PC-NFS (see above); plus PC Ethernet board	_____
PC-NFS-3C	PC Ethernet board	_____
PC-NFS-MC	Microchannel Ethernet board	_____
PC-NFS-56	RTU License for one PC PC-NFS software on 5-1/4 inch diskettes	_____
PC-NFS-09	PC-NFS documentation	_____
PC-NFS-PTK	RTU License for one PC 5-1/4 inch diskettes PC-NFS Toolkit doc.	_____
PC-NFS-PTK-SL	Site License for Toolkit 2 complete PC-NFS-PTKs 4 additional doc. sets	_____
PC-NFS-PTK-09	PC-NFS Toolkit doc.	_____
PC-LifeLine-51(M)	RTU License for one PC LifeLine software and doc.	_____
PC-LifeLine-SL	Site License for LifeLine LifeLine software 10 Copies LifeLine doc.	_____
PC-NFS-3.0.1-51UP	3.0 to 3.0.1 upgrade kit.	_____
PC-NFS-3.0.1-51UF	Pre 3.0 to 3.0.1 upgrade kit.	_____

*(M) indicates this model can be ordered on 3-1/2 inch diskettes.

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Introduction

PC-NFS is a set of applications designed to help you get the most out of your PC and network environment.

This book is designed to help you install and use PC-NFS. The next few pages describe the conventions used in this book and provide an introduction to PC-NFS window applications.

If you want to go right ahead and install PC-NFS, have your system administrator complete the form that follows the end of this chapter. When you have the completed form, which contains information you need to install PC-NFS, turn to Chapter 2 to start the installation.

The first and second chapters of this book are a guide to the installation and configuration of PC-NFS. The remaining chapters detail advanced configuration and system administrator information regarding the NFS server.

For a more general introduction to PC-NFS and a commands reference section see the *PC-NFS User's Manual.*

This manual uses the following conventions:

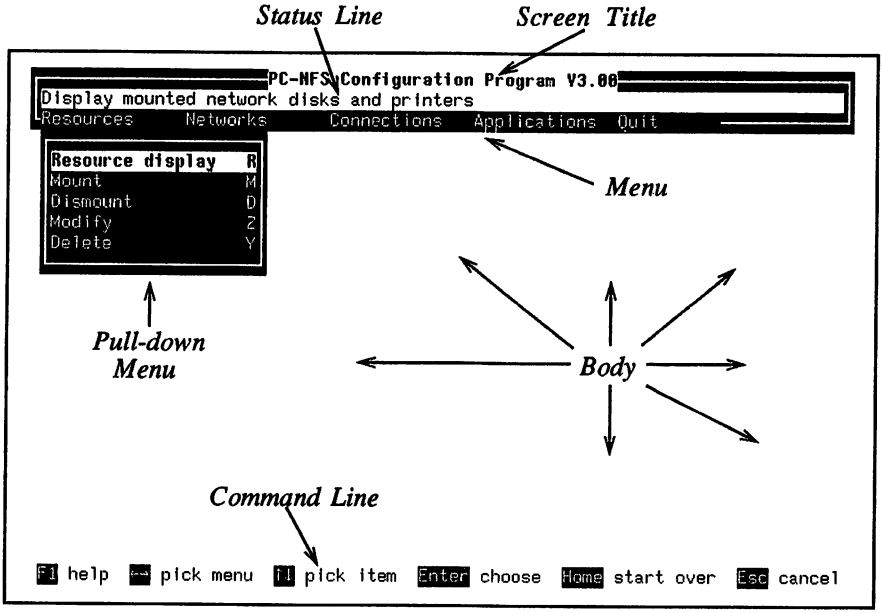
Italic print	to introduce a new term, or for emphasis
`Courier`	to indicate command or program names or output on a screen
`Bold Courier`	to indicate what you, the user, type

PC-NFS Window Applications

The installation and configuration programs for PC-NFS are PC-NFS window applications. If you have never used PC-NFS window applications, read through this section to acquaint yourself with window terminology before you install and configure PC-NFS.

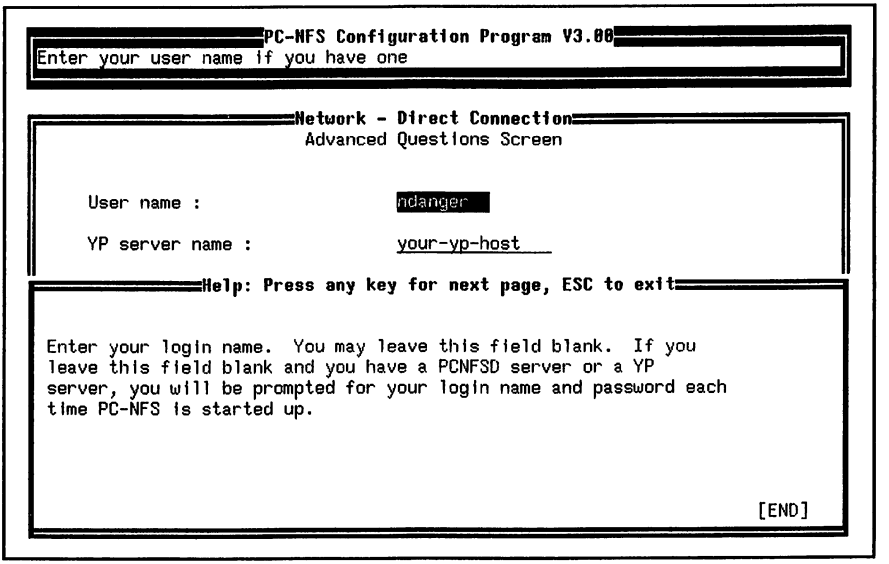
Window

Every window application begins by displaying a screen of information that provides you with options for running the application. This display is known as a *window*. A window has a border around it, and may have other components as well. This is a sample PC-NFS configuration window:



Help Windows

In PC-NFS window applications you can always press F1 for help. Pressing F1 for help displays a help window:

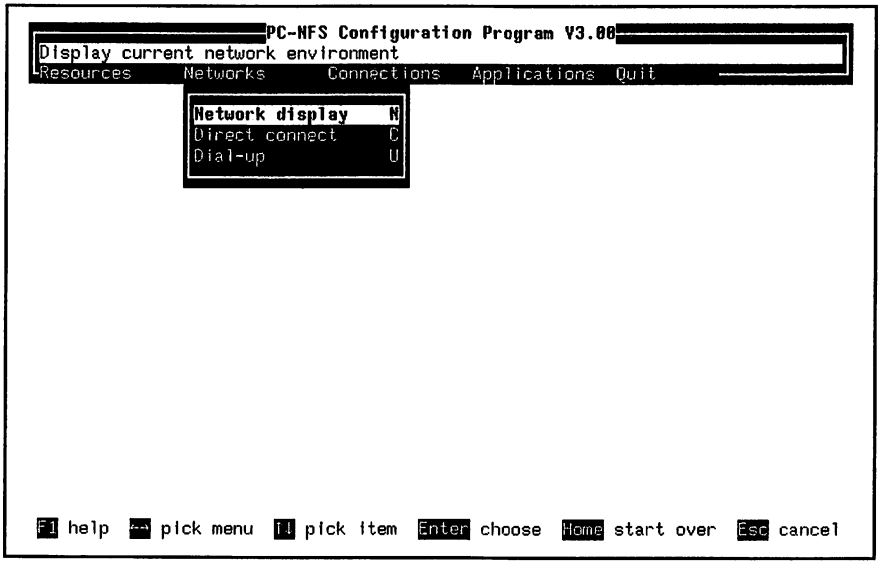


The help window *pops up* on top of the main window, at the bottom of the screen. You can *page* through the help text by pressing any key.

When you're finished reading the help text, press Esc to remove the help window.

Menus

When you have more than one option, PC-NFS window applications display your options on a *menu*. In the screen below, the top part of the window displays several options, and a list of commands, known as *pull-down menu* displayed under the `Networks` menu.



One command on the pull-down menu is *highlighted*. This means that it stands out from the other commands because it's in a different color from the other commands or, on a one-color system, it's displayed in *reverse video*. (Reverse video means that the display is the opposite of what you normally see. For example, if your display is usually black on white, reverse video displays white on black.)

In the Network menu above, the `Network display` command is highlighted. The status line contains a brief description of the command currently highlighted. You can press F1 to get more information about it.

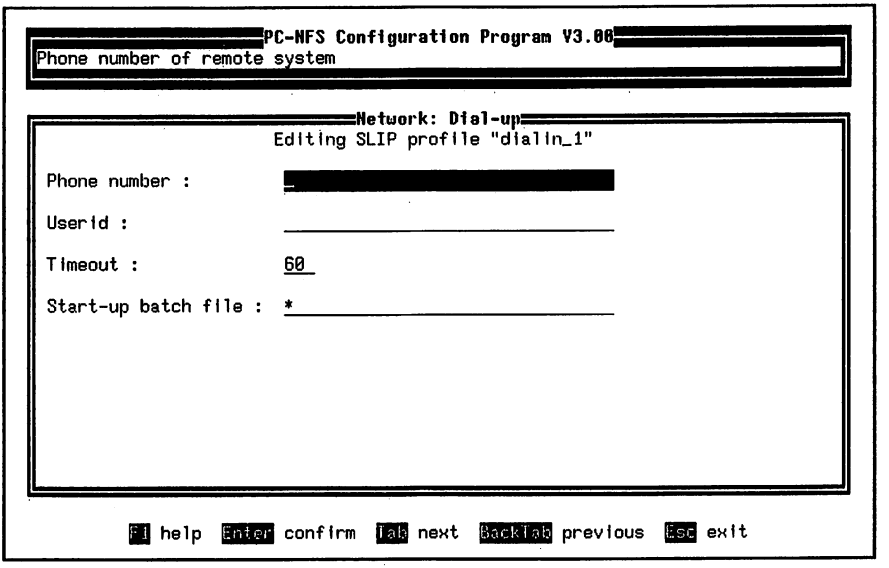
To *select* a command use the up and down arrow keys on the cursor control keypad to highlight the command you want. When you have highlighted the command you want, press Enter.

Note that each command in the pull-down menu has a single character after it. This character is the *command accelerator* for this command. If you want to select the command without using the menus, you can enter the command accelerator.

Use the Esc key to move back one menu level. You can use the Home key to return to the top most pull-down menu where you began.

Form Windows

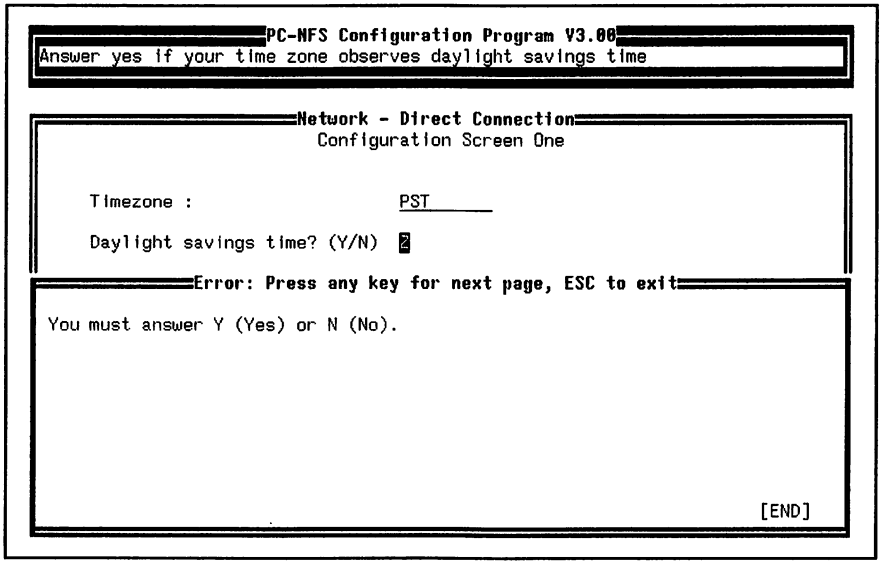
Some PC-NFS window applications use *form windows* to gather information. These windows contain at least one question that you need to answer. Some form window questions provide a *default* answer. The default answer is what the application uses if you don't specify something else. The PC-NFS `nfsconf` program uses form windows:



Use the Tab and Shift Tab (*backtab*) keys to move between fields on the same page.

Error Windows

If a PC-NFS window application detects an error or wants to warn you that the action you have requested has potentially damaging effects, an Error window pops up in the middle of your screen.



The window gives you directions about how to proceed.

Configuration Form

The next page contains a form that your system administrator must fill in. You need the information on the form to install PC-NFS successfully.

PC-NFS Configuration Form

FULL NAME:_____

USER NAME:_____

ETHERNET ADDRESS:_____

Dear System Administrator:

This user needs information to configure PC-NFS. Please complete this form and return it to the user. Thank you.

Time Zone: _____

Does your community observe Daylight Savings Time (Y/N): ____

Do you have Yellow Pages (Y/N)? ____

Do you have RARP (Y/N)? ____

Do you have a PCNFSD Server (Y/N): __

If the user has Yellow Pages and RARP, answer the following questions:

Yellow Pages Domain Name: _____

If your network has Yellow Pages but no RARP, answer the following questions:

PC Name: _____

IP Address of PC: _____

Yellow Pages Domain Name: _____

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If your network has RARP but no Yellow Pages, answer the following questions:

PC Name: _____

IP Address of PC: _____

PCNFSD Server Name: _____

IP Address of PCNFSD Server: _____

If your network has neither Yellow Pages nor RARP, answer the following questions:

PC Name: _____

IP Address of PC: _____

PCNFSD Server Name: _____

IP Address of PCNFSD Server: _____

Network Printers:

If your network has networked printers, answer the following questions:

`LPT1:` _____ printer name

_____ printer server

_____ printer server Internet address

`LPT2:` _____ printer name

_____ printer server

_____ printer server Internet address

`LPT3:` _____ printer name

_____ printer server

_____ printer server Internet address

Serial Connection Information

If this connection is via a serial line, answer the following additional questions as appropriate, whether direct or dial-up:

Baud Rate: _____

Gateway Name: _____

Gateway Address: _____

Dial-up Server: _____

Dial-up Phone Number: _____

Installing PC-NFS

1

Before you install PC-NFS on your PC, there are several steps that you must complete. The sections that follow explain the entire procedure outlined below in detail.

1. Make sure that your hardware and software environments match the requirements for PC-NFS.
2. Install the Ethernet® communications board or use the serial port in your PC to connect to the network.
3. If you are using Ethernet, determine the Ethernet address of your PC's communications board. If you are using serial, determine the COM port and baud rate.
4. Take your Configuration Form, located just before this chapter, to your system administrator. If you are using Ethernet, make sure you fill in your Ethernet address before giving the form to your system administrator.
5. Make sure that any network software already on your PC will coexist with PC-NFS.
6. Back up your PC-NFS distribution diskettes.
7. Obtain the completed Configuration Form from your system administrator and install PC-NFS.

Hardware and Software Requirements

This section describes the minimum hardware and software you need to install and run PC-NFS.

Hardware Requirements:

- One IBM Personal Computer™ (PC), XT™, Personal Computer AT® (PC AT), Personal System/2™ (S/2), or 100% IBM® PC-compatible personal computer, such as Compaq®, Compaq Deskpro®, Compaq Portable 286®, Leading Edge Model D® or a SunIPC™.
- At least 512 Kbytes of usable RAM. PC-NFS uses approximately 80 to 90 Kbytes. The PC resident program `prt.exe` (used for remote printing) requires approximately 4.5 Kbytes. The remaining RAM is generally available for your programs, although PC-NFS does occasionally use additional memory to execute certain utilities.
- To install PC-NFS 3.0.1 on a hard disk for the first time, you need at least 1.75 Kbytes of free space. If you are upgrading from PC-NFS 1.0 or 2.0, you need 1 Mbyte of free space. If you are upgrading from PC-NFS 3.0, you need 30 Kbytes of free space.
- One double-sided, double-density diskette drive.
- Ethernet board or serial port. Ethernet communications board option include:
  - 3Com® 3C501, 3C503, 3C505, 3C523
  - Ungermann-Bass PC-NIC™
  - Western Digital WD8003E
  - MICOM Interlan® NI5010
- One thin Ethernet T-tap or one standard Ethernet transceiver and cable.

  A serial port requires an RS232C cable on your `COM` port or a Hayes-compatible modem.

Software Requirements:

- IBM's PC-DOS® version 3.0 or later, *or* a compatible version based on Microsoft's MS-DOS® version 3.0 or later. Note that DOS 3.1 or later is required for certain utilities.
- One or more Sun-2, Sun-3, Sun-4 or Sun386i servers running SunOS™ Version 2 or later, *or* one or more other servers that support NFS, such as a DEC VAX® running the UNIX® operating system. SunOS version 3.2 or later is recommended.

If you know your Ethernet address, your communications board is installed, and you need no further information, or if you are upgrading from a previous release of PC-NFS, proceed to the section, "Installing PC-NFS," in this chapter.

Installing the Communications Board

PC-NFS requires an Ethernet communications board or serial board installed in your system. The supported network boards are:

- 3C501 3Com Etherlink
- 3C503 3Com Etherlink II
- 3C505 3Com Etherlink Plus
- 3C523 3Com Microchannel
- PC-NIC Ungermann-Bass
- NI5010 Micom-Interlan
- WD8003E Western Digital

The possible serial links are:

- Serial (dial-up) - requires a Hayes-compatible modem
- Serial (direct)

If your PC does not have a communications board or serial card installed, you must install one before you can install the PC-NFS software.

Note that communications boards are extremely sensitive to static electricity. Follow the installation instructions that come with the board or have someone who is familiar with the board install it for you.

If you are using a serial port to connect to the network, proceed to the section, "Network Coexistence."

Once the communications board is installed, you must obtain its Ethernet address, as explained in the next section. Also, if the communications board was originally installed to run software other than PC-NFS, you must make sure that the software can coexist with PC-NFS. The section, "Network Coexistence," in this chapter explains how to check for conflicts.

Determining the Ethernet Address

Every Ethernet board comes from the manufacturer with a unique *Ethernet address*. An Ethernet address is a six-part hexadecimal number in which a colon (:) separates each part. For example:

```
8:0:20:1:2f:0
```

Note that the address *cannot* be 0:0:0:0:0:0 or ff:ff:ff:ff:ff:ff.

You need to supply this address to your system administrator on the Configuration Form that appears before Chapter 1. The system administrator may need to enter this address in a network database. The PC-NFS distribution diskettes contain a program, `myeaddr`, that finds the Ethernet address for you.

Most communication boards have either an I/O port address or a shared memory address. Following the procedures below, you must determine the communications board I/O port address or shared memory address to determine its Ethernet address. If a supported board does not have these parameters, you can still use the program to find its Ethernet address.

If the communications board is not installed, install it before proceeding.

Default Settings

First, find out whether the network board was installed with factory (default) settings, or whether it was reconfigured to use a different I/O port address, shared memory address, or interrupt number. If you don't know, assume the default factory settings. If it was reconfigured, turn to the next section, "Reconfigured Settings," to determine your Ethernet address.

Some boards, such as the 3Com 3C523, work with the `myeaddr` program as described below even when they do not have the factory settings. For these boards you do not have to consult the "Reconfigured Settings" section.

To run the `myeaddr` program, place the PC-NFS Configuration distribution diskette into drive `A` and type:

```
C>A:myeaddr <board_type>
```

where *board_type* is one of the communication boards listed under "Hardware Requirements," earlier in this chapter.

For instance, for a 3C501 board, enter:

```
C>A:myeaddr 3C501
```

The system displays the Ethernet address in the following format:

```
Your 3C501 Ethernet address is xx:xx:xx:xx:xx:xx
```

Enter this number on your Configuration Form and proceed to the section, "Network Coexistence."

Reconfigured Settings

If your board is not set to the factory settings, it is reconfigured. You can still use the `myeaddr` program to determine the board's Ethernet address, but you must enter information in addition to the board type.

The columns in Table 1-1 identify the boards that have an I/O Port Address, a Shared Memory Address, or Neither. The Neither boards do not require a parameter for `myeaddr` to determine the Ethernet address.

Table 1-1 *Table of Board's Parameters*

I/O Port Address	Shared Memory Address	Neither
3C501 3C503 3C505 NI5010 WD8003E	NIC	3C523

There is no software method to find the I/O port address or the shared memory address. You must get the address from the person who changed the factory settings. You can consult Tables 1-2 and 1-3 on page 19 to find acceptable ranges for these values. Table 1-3 also contains the interrupt number which you need.

Once you have the correct address, run the `myeaddr` program. To run the program, place the PC-NFS distribution Configuration diskette into drive `A` and type:

`C>`**`A:myeaddr`** *<board_type>* [*<ioport_addr* | *shmem_addr>* [*<int#>*]]

Always enter board_type (3C501, 3C503, 3C505, NIC, 3C523, NI5010, or WD8003E), the I/O *port address* or *shared memory address* for the board, and the *interrupt number* the board is configured for (if it was changed). For example, for a NIC board using a shared memory address of 0xE000 or E000H and interrupt number 7, enter:

```
C>A:myeaddr NIC E000 7
```

The program displays the Ethernet address in the form:

```
Your NIC Ethernet address is xx:xx:xx:xx:xx:xx
```

Enter your Ethernet address on the PC-NFS Configuration Form and deliver the form to your system administrator.

Network Coexistence

There are a number of networks that run on personal computers. PC-NFS can coexist with the following:

1. IBM PC Network
2. TOPS®

You should add the command `net pcnet` to your `AUTOEXEC.BAT` file if you plan to run the IBM PC-Network simultaneously with PC-NFS. For details on the usage of the `net pcnet` command see Chapter 8, "Commands Reference," in the *PC-NFS User's Manual.*

To use TOPS with PC-NFS, you must edit the `TOPSKRNL` file which is in the `TOPS` directory. This file overrides the default setup for TOPS. The file format for the `TOPSKRNL` file appears in an appendix of the TOPS manual. This file contains the following two lines:

```
Last logical Drive (C - Z):J
Last logical Drive (C - Z):S
```

Replace these lines with the two lines similar to the following:

```
FFHUUUUUUU
FFHHHHHHHHUUUUUUUUUU
```

Each `F` stands for a diskette drive, each `H` stands for a local hard disk drive, and each `U` for an unused drive available for TOPS. The configuration above permits PC-NFS-mounted drives on DOS drives `D - J` and TOPS drives on DOS drives `K - S`. You can enter the `H`'s and `U`'s in any order that you wish, although you cannot use drives `T`, `U` , and `V`. You must start the TOPS network before the PC-NFS program to run the two concurrently.

If you are using any other DOS network, it must be disabled before installing PC-NFS. Be sure to check the documentation that accompanied the other network software to see how to disable it. If you do not disable a non-supported network, you may experience unexpected results.

Backing Up the Distribution Diskettes

Before you use the PC-NFS distribution diskettes, make copies of the original diskettes and store the originals safely away. Be sure to compare the two sets to make sure that your copy is OK. Use the copies to install PC-NFS.

Use the DOS `COPY` command to back up your PC-NFS distribution diskettes. See the *DOS Manual* for your PC for an explanation of the `COPY` procedure for both single- and double-drive personal computers.

Installing PC-NFS

You can install PC-NFS on these hardware configurations:

- Hard disk system
- Diskette only system
- SunIPC

For each of these systems there is a section for a first-time installation and a section for an upgrade installation. Proceed to the section that best suits your installation needs.

Hard Disk Upgrade Installation

Your installation procedure differs slightly from a first-time installation since you have a previous version of PC-NFS on your system. You will see an additional screen after the copyright screen, asking:

```
Do you wish to do an upgrade (y/n)?
```

Your previously installed PC-NFS has a unique serial number. If you answer **Y** to this prompt you will retain your old serial number. If you answer **N**, you will get a new serial number when you install the upgrade.

The PC-NFS installation program uses the values from your current configuration as the default values. Pressing Enter for each of the questions in the installation process keeps your original configuration.

The rest of the procedure is identical to a first-time installation with the following exception. After you load all the diskettes, you do not have to configure PC-NFS, it uses your old configuration. You should reboot, to bring up the new version of PC-NFS. If you want to reconfigure any part of the program or mount new network disk or network printers, run the `nfsconf` program after you reboot. Follow the directions in the next section to install your upgrade.

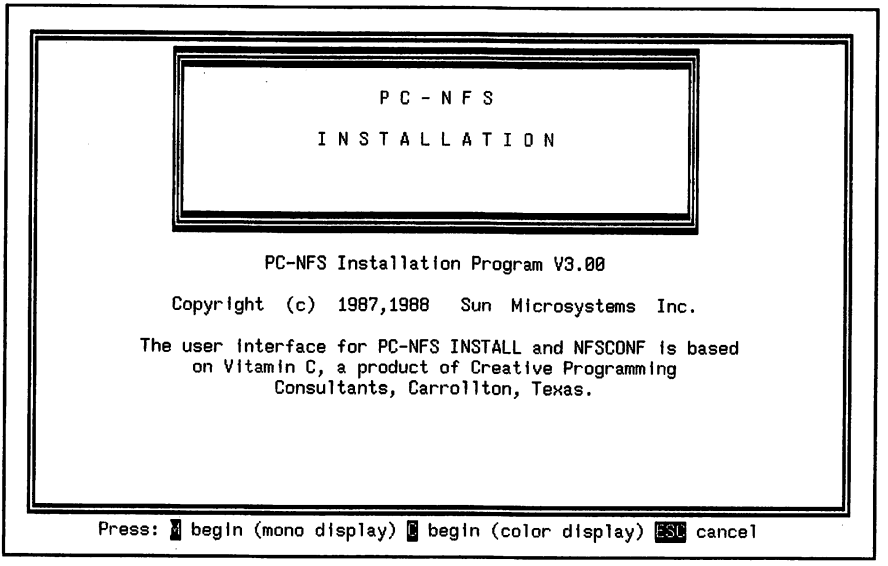
Hard Disk First-Time Installation

To begin the PC-NFS installation:

1. Insert the first PC-NFS installation diskette into your diskette drive.
2. At the DOS prompt >, type:

   >A:

   where A is the drive the diskette is in.
3. Type **`install`** and press (Enter). The copyright screen displays:



You must select either (M) for a monochrome display or (C) for a color display to continue. There is no default value. If you want to quit the installation, press (Esc).

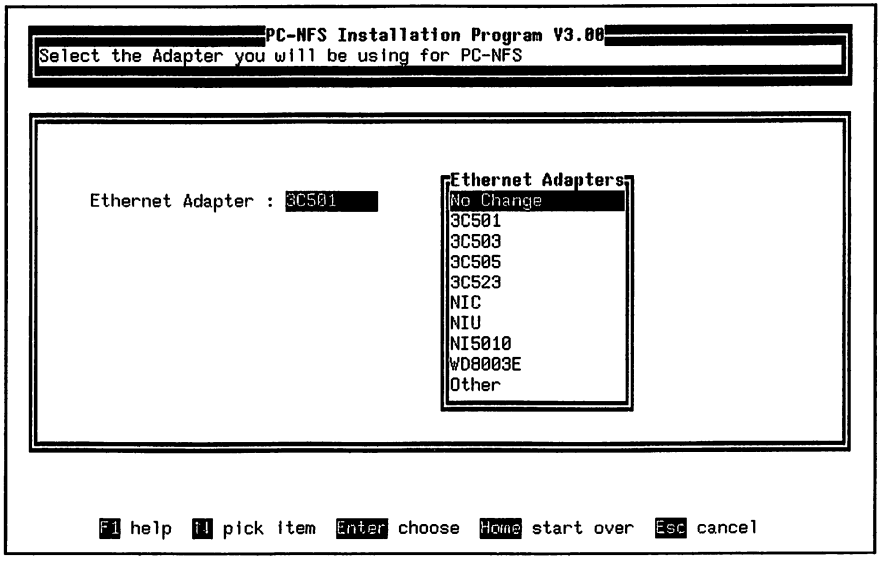
The PC-NFS installation program begins by asking you where you want to install PC-NFS. Enter the letter of the drive where you want to install PC-NFS. Note that you can not install onto the same drive from which you are running the installation program. For example, if you are installing from drive A, you cannot install PC-NFS onto drive A.

As you answer the questions in the PC-NFS installation and configuration programs, remember that you can press F1 for help at any time up to the point where you start copying diskettes.

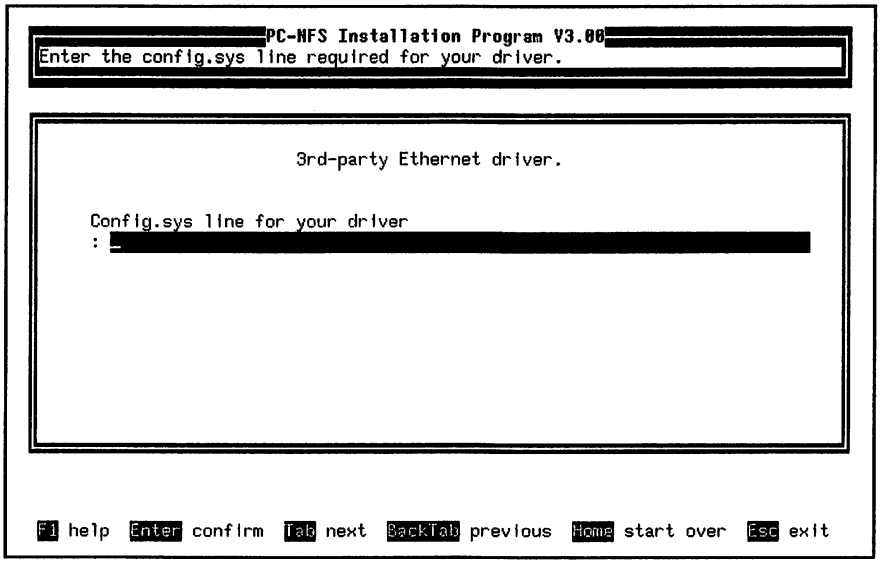
Connections Configuration

This screen asks you to select either Ethernet or serial. Make the appropriate choice for your configuration. If you select serial, proceed to the section "Serial Installation."

Ethernet Installation. If you select Ethernet, the PC-NFS installation program displays a menu of network boards. Use the up and down arrow keys to highlight the board you are using for PC-NFS, and press Enter. If you do not know which network board you have, ask your system administrator.



If your board does not appear on the list, select `Other`. The following screen appears.



The prompt is asking you to enter a line of the form:

`DEVICE =` *pathname*

which will be added to your CONFIG.SYS file. For the *pathname* portion of the entry, type the path for the device driver for your third-party Ethernet board.

For most network boards, the PC-NFS installation program asks you for an interrupt number and I/O port address. Use Tables 1-2 and 1-3 to help you determine these values.

The default settings for these parameters are as follows:

Table 1-1 *Communications Network Board Default Parameters*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	3	300	----
3C503	3	300	----
3C505	3	300	----
NI5010	3	300	----
NIC	2		D000H
WD8003E*	2	280	D000H

* Western Digital now ships several boards that are software compatible with the WD8003E. The interrupt default of these boards is usually 3. Be sure to enter the correct interrupt when you install PC-NFS or when you change your Ethernet configuration.

The following chart shows the acceptable ranges for these parameters:

Table 1-2 *Communications Network Board Parameter Ranges*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	2-7	200H-3F0H	----
3C503	2-5	250H-350H	----
3C505	3-7,9 (PC) 3-7,9-12,14,15 (AT)	200H-3F0H	----
NI5010	3 or 5	200H-3E0H	----
NIC	2-7	----	8000H-F800H (512K) - (992K)
WD8003E	2-7	200H-3E0H	8000H-F800H

In some cases the PC-NFS installation program asks you for a DMA Channel and Transceiver Type. Use the following table to help you determine these values. The transceiver values are thick and thin. The program accepts numeric values for this parameter, 1 for thin, 2 for thick. If you are unsure, use the default value for both parameters.

Table 1-1 *DMA Values and Transceiver Types*

Board	DMA Values	Default DMA Value	Default Transceiver Type
3C503	1, 2, 3	1	thin
3C505	0, 1, 3 (AT 8 bit) 5-7 (AT 16 bit)	1	

If you do not know how to answer any questions about your network connections, ask your system administrator for help.

Serial Installation. If you chose serial, the program asks whether you are directly connected or dialing up the server. Select either `direct` or `dial-up` as appropriate. The PC-NFS installation program then asks you for the communications port to be used (`COM1` or `COM2`) and for the baud rate (1200, 2400, 4800, or 9600).

Loading the Distribution Diskettes

Before beginning the actual installation, the PC-NFS installation program allows you to go back and change any of your responses. When you're ready to begin the actual installation, press Enter.

The PC-NFS installation program asks you to load the installation diskettes. When you have successfully loaded the installation diskettes, the PC-NFS installation program asks you if you are ready to continue. If you are, it starts the `nfsconf` program. If you are not ready to continue, press Esc to exit to DOS. If you do exit to DOS, however, note that your environment is in an inconsistent state, and you should run `nfsconf` and then reboot as soon as possible.

For the next step in the installation process, proceed to Chapter 2, "Configuring PC-NFS."

Diskette-Only Upgrade Installation

You must follow the steps below to prepare a new diskette from your current diskette. You will then be able to perform an upgrade to the new diskette.

1. Make a formatted bootable diskette following the procedure "Creating a Bootable DOS Diskette," in the next section.
2. Copy `ANSI.SYS` from the DOS distribution diskette to the root directory of the new diskette.
3. Copy these files from your present PC-NFS boot diskette to the new diskette:
   - `CONFIG.SYS`
   - `AUTOEXEC.BAT`
   - `\NFS\PCNFS.SYS`
   - `\NFS\HOSTS`
   - `\NFS\RESPOOL.DB`
4. If they are present on your the PC-NFS diskette, also copy these files to the new diskette:
   - `\NFS\DRIVES.BAT`
   - `\NFS\NETWORK.BAT`
   - `\NFS\LPCNF0,LPCNF1,LPCNF2,LPCNF3`
   - `\NFS\SERVICES`
   - `\NFS\ETHERS`
   - `\NFS\NETWORKS`
   - `\NFS\PASSWD`
   - `\NFS\PROTOCOLS`
   - `\NFS\RPC`
5. Run the installation program following the procedure "PC-NFS Installation," in the next section. The PC-NFS installation program uses the values from your current configuration as the default values. Pressing Enter in response to each of the questions in the installation process keeps your original configuration.

When the PC-NFS installation is complete, you should reboot your PC to start the new version of PC-NFS. If you want to change the PC-NFS configuration or mount new network disks or network printers, use the `nfsconf` program. Otherwise, your old configuration is retained.

Differences during Upgrade

If the PC-NFS installation diskette contains a serialized version of `PCNFS.SYS`, your installation procedure differs slightly from a first-time installation. You will see an additional screen after the copyright screen, asking:

```
Do you wish to do an upgrade (y/n)?
```

Your existing PC-NFS software has a unique serial number. If you answer **y** to this prompt the old serial number is retained. If you answer **n**, the upgrade software is installed with a new serial number.

Diskette-Only First-Time Installation

In general, you can create a boot diskette with PC-NFS using the installation program supplied by PC-NFS. The instructions which follow use that procedure.

Exception Configurations

If you plan to use a 3Com 3C505 board, the following instructions do not apply. Instead, follow the instructions in Appendix C, "Diskette Installation," of this manual.

If you are creating a SLIP installation, see Chapter 4, "Installing and Using SLIP on Your PC," in the *PC-NFS Serial Communications Guide*.

Otherwise, continue with the following instructions.

Creating a Bootable DOS Diskette

If you are installing PC-NFS on a diskette-only PC, you need to prepare a bootable DOS diskette before you run the PC-NFS installation program. To create this diskette, use the DOS `Format` command, located on your DOS distribution diskette, as follows:

1. Insert the DOS distribution diskette into drive A.
2. Insert a blank, unformatted diskette into drive B.
3. At the drive A DOS prompt, type:

   `format B: /s`

   and press Enter. The following message is displayed.

   ```
   Insert new diskette for drive B:
   and strike ENTER when ready
   ```

4. Press (Enter) . When the formatting is completed your screen should appear similar to that shown below:

```
A>FORMAT B: /s
Insert new diskette for drive B:
and strike ENTER when ready

Formatting...Format complete
System transferred

362496 bytes total disk space
 40960 bytes used by system
321536 bytes available on disk
```

Installing ANSI.SYS

Copy ANSI.SYS from the DOS distribution diskette to the root directory of the new diskette. The PC-NFS utilities all use ANSI control codes to format their screen displays. For this to work, you must have a copy of the ANSI.SYS device driver (distributed with your PC-DOS or MS-DOS system) installed in your root directory.

After creating your bootable DOS diskette, refer to the appropriate section of this manual for instructions on continuing the installation.

Running PC-NFS Utilities

If you are installing PC-NFS on a diskette-only PC with low-density (360 KB) drives, you do not have room on a single diskette for all of the software that PC-NFS provides. To use additional software, you can:

- Load the appropriate PC-NFS diskette into your second drive, and run the software from that drive;

  or

- Copy the additional software to a remote file system and run it from there.

After you complete the installation, see Chapter 3, "Tailoring Your System," in *Installing PC-NFS, A Guide to the User and System Administrator* for more information about executing PC-NFS utilities from a remote file system.

On a single diskette drive PC: Because of limited space on the PC-NFS Utilities diskette, screen messages and prompts for PC-NFS utilities are located on the PC-NFS Program diskette that you create during installation. Therefore, when you run a utility from a PC-NFS diskette on a single diskette drive PC, the utility is unable to access and display any messages or prompts. Instead, error messages similar to the following are displayed:

```
PC-NFS Message #221
        PC-NFS Message #225
        PC-NFS Message #226
PC-NFS Message #197
```

To run PC-NFS utilities on a single diskette drive PC, install and run the utilities on a remote file system.

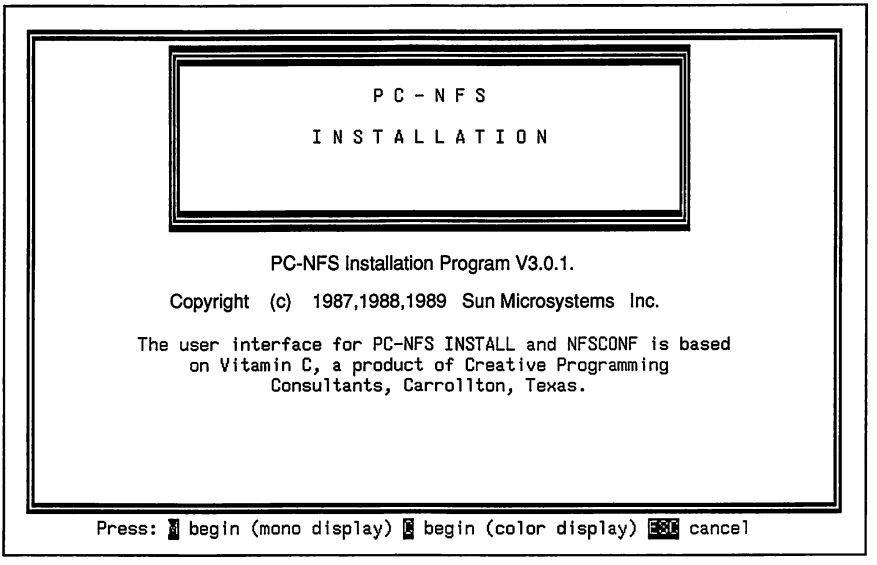
PC-NFS Installation

To begin the PC-NFS installation:

1. Insert the first PC-NFS installation diskette into your diskette drive.
2. At the DOS prompt, >, type:

   A:

   where A is the drive the diskette is in.
3. Type **install** and press Enter. The copyright screen is displayed:



   You must select either M for a monochrome display or C for a color display to continue. There is no default value. If you want to quit the installation, press Esc.

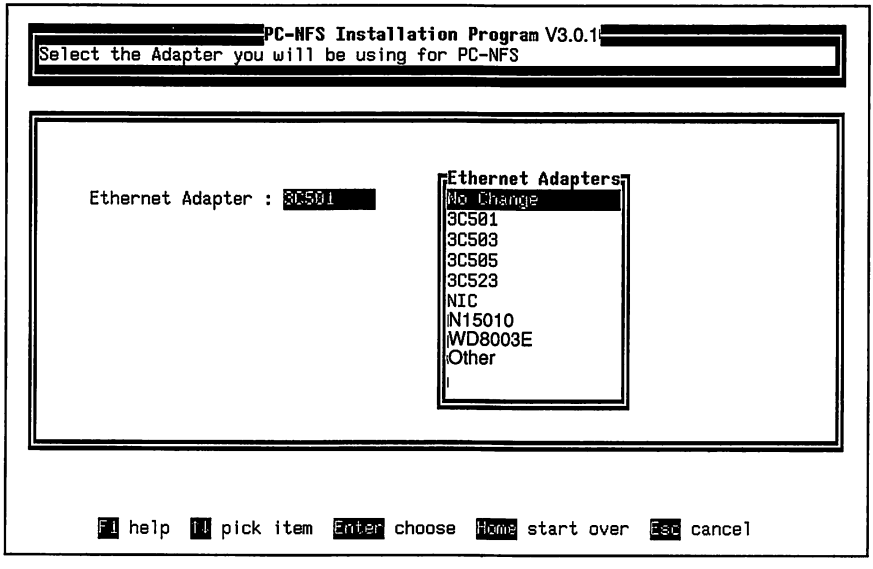
The PC-NFS installation program begins by asking you where you want to install PC-NFS. Enter the letter of the drive where you want to install PC-NFS. Note that you cannot install onto the same drive from which you are running the installation program. For example, if you are installing from drive A, you cannot install PC-NFS onto drive A.

As you answer the questions in the PC-NFS installation and configuration programs, remember that you can press F1 for help at any time up to the point where you start copying diskettes.

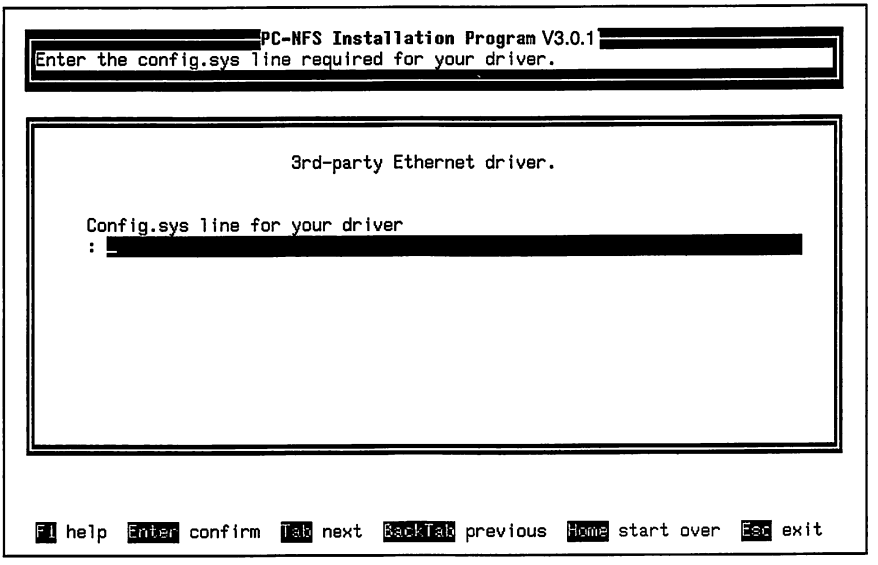
Connections Configuration

The next screen asks you to select either Ethernet or serial. Make the appropriate choice. If you select serial, refer to the instructions in Chapter 4 "Installing and Using SLIP on Your PC," of the *PC-NFS Serial Communications Guide*. The following instructions are only for Ethernet configurations.

If you select Ethernet, the PC-NFS installation program displays a menu of network boards. Use the up and down arrow keys to highlight the board you are using for PC-NFS, and press Enter . If you do not know which network board you have, ask your system administrator.



If your board does not appear on the list, select `Other`. The following screen appears:



The prompt is asking you to enter a line in this form:

`DEVICE =` *pathname*

The line will be added to your CONFIG.SYS file. For the *pathname* portion of the entry, include the path for the device driver for your third-party Ethernet board.

Loading the Distribution Diskettes

Before beginning the actual installation, the PC-NFS installation program allows you to go back and change any of your responses. When you're ready to begin the actual installation, press Enter.

The PC-NFS installation program asks you to load the installation diskettes. When you have successfully loaded the installation diskettes, the PC-NFS installation program asks you if you are ready to continue. If you are, it starts the `nfsconf` program. If you are not ready to continue, press Esc to exit to DOS. If you do exit to DOS, however, note that your environment is in an inconsistent state, and you should run `nfsconf` and then reboot as soon as possible.

For the next step in the installation process, proceed to Chapter 2, "Configuring PC-NFS."

SunIPC Upgrade Installation

Your installation procedure differs slightly from a first-time installation since you have a previous version of PC-NFS on your system. You will see an additional screen after the copyright screen, asking:

```
Do you wish to do an upgrade (y/n)?
```

Your previously installed PC-NFS has a unique serial number. If you answer **y** to this prompt you will retain your old serial number. If you answer **n**, you will get a new serial number when you install the upgrade.

The PC-NFS installation program uses the values from your current configuration as the default values. Pressing Enter for each of the questions in the installation process keeps your original configuration.

The rest of the procedure is identical to a first-time installation with the following exception. After you load all the diskettes, you do not have to configure PC-NFS; it uses your old configuration. You should reboot, to bring up the new version of PC-NFS. If you want to reconfigure any part of the program or mount a new network disk or network printers, run the `nfsconf` program after you reboot. Follow the directions in the next section to install your upgrade.

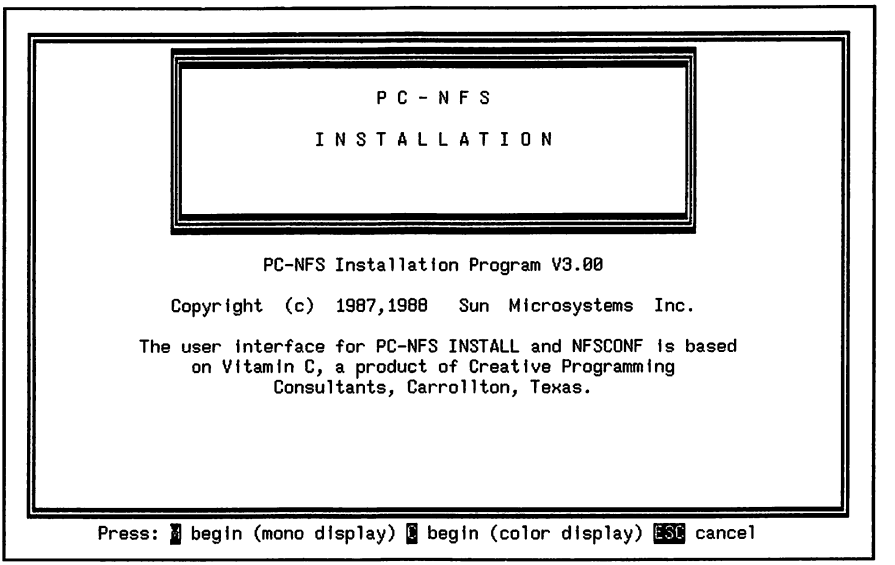
SunIPC First Time Installation

To begin the PC-NFS installation:

1. Insert the first PC-NFS installation diskette into your diskette drive.
2. At the DOS prompt, >, type:

   >A:

   where A is the drive the diskette is in.
3. Type **install** and press Enter. The copyright screen displays:

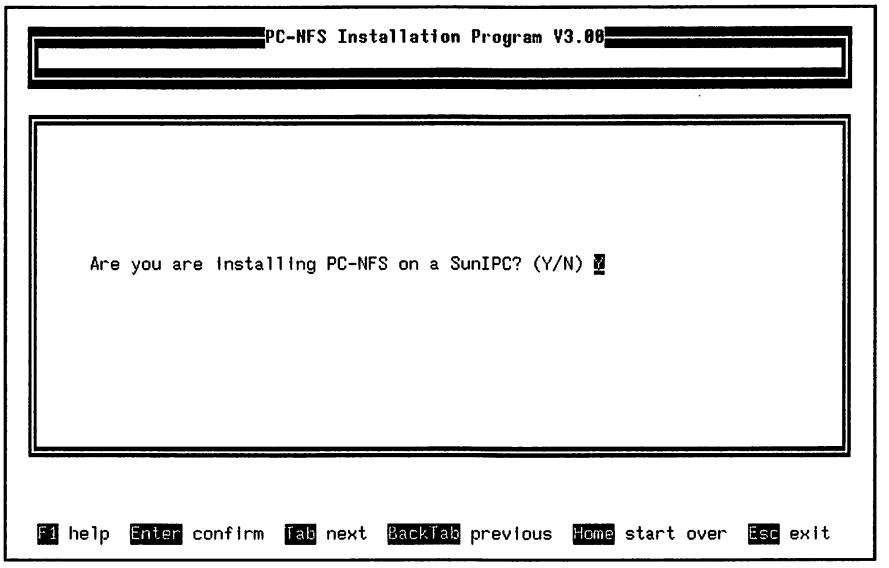


   You must select either M for a monochrome display or C for a color display to continue. There is no default value. If you want to quit the installation, press Esc.

The PC-NFS installation program begins by asking you where you want to install PC-NFS. Enter the letter of the drive where you want to install PC-NFS. Note that you can not install onto the same drive from which you are running the installation program. For example, if you are installing from drive A, you can not install PC-NFS onto drive A.

As you answer the questions in the PC-NFS installation and configuration programs, remember that you can press F1 for help at any time up to the point where you start copying diskettes.

The following screen appears:



Confirm that you are running a SunIPC. The PC-NFS installation program asks you to load the installation diskettes, as described below.

Loading the Distribution Diskettes

Before beginning the actual installation, the PC-NFS installation program allows you to go back and change any of your responses. When you're ready to begin the actual installation, press (Enter).

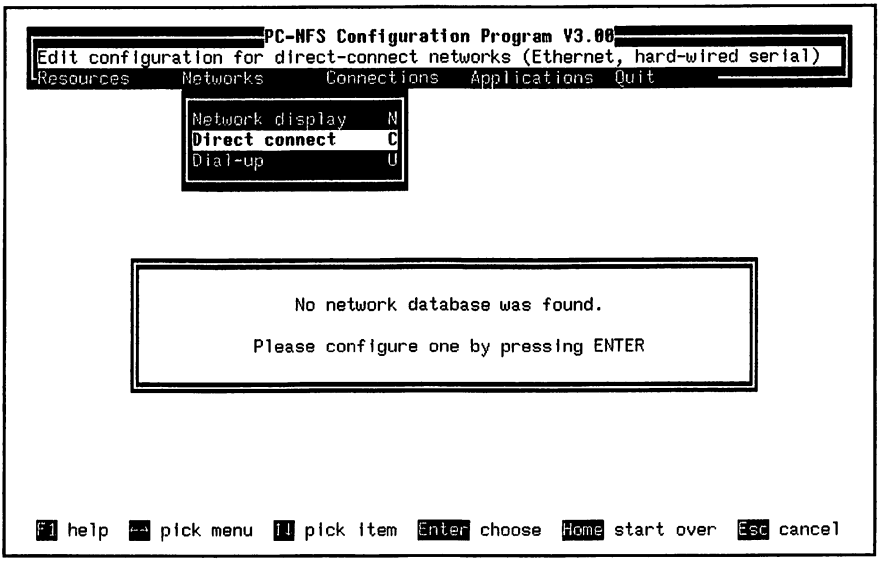
The PC-NFS installation program asks you to load the installation diskettes. When you have successfully loaded the installation diskettes, the PC-NFS installation program asks you if you are ready to continue. If you are, it starts the `nfsconf` program. If you are not ready to continue, press (Esc) to exit to DOS. If you do exit to DOS, however, note that your environment is in an inconsistent state, and you should run `nfsconf` and then reboot as soon as possible.

For the next step in the installation process, proceed to Chapter 2, "Configuring PC-NFS."

Configuring PC-NFS

2

You need to tell PC-NFS about your environment. When you've loaded all of the PC-NFS installation diskettes, you need to configure PC-NFS to your environment using the PC-NFS configuration program. If you have just completed loading the PC-NFS diskettes, the PC-NFS installation program asks you if you are ready to continue. If you are, it starts up the `nfsconf` program. If you are not ready to continue, press Esc to exit to DOS. When the program begins, the following displays on the screen:



This is the main menu of the configuration program `nfsconf`. If the screen shown above does not match your screen, enter:

```
C>nfsconf
```

to start the configuration program. You can use this program **anytime** to display or change your PC-NFS configuration or mount disks and printers.

If you are upgrading, you do not need to reconfigure. The PC-NFS install program uses your old configuration. If you want to change your configuration, follow the directions above to start the configuration program.

You can use the configuration program at any time to modify your start-up configuration for the next reboot of the system. However, you can also use this program to mount remote file systems and remote printers for immediate use. You do not have to reboot the system to mount these devices.

Earlier you gave your system administrator a PC-NFS Configuration form to complete. You will need this filled out form to successfully configure PC-NFS for your system and network.

Configuring Your Network

The PC-NFS configuration program, `nfsconf`, has five items on its main menu as shown in the preceding figure.

Each menu item controls the following:

`Resources`	Mounted disks and printers
`Networks`	Network environment
`Connections`	Type of network board in use, Ethernet or serial
`Applications`	Other PC-NFS applications that work with PC-NFS
`Quit`	Exit to DOS

To move the cursor from one field to another in the pull-down menus, use the arrow keys. The next several sections discuss these menu selections in detail.

Resources

There are five options available for the `Resources` menu item:

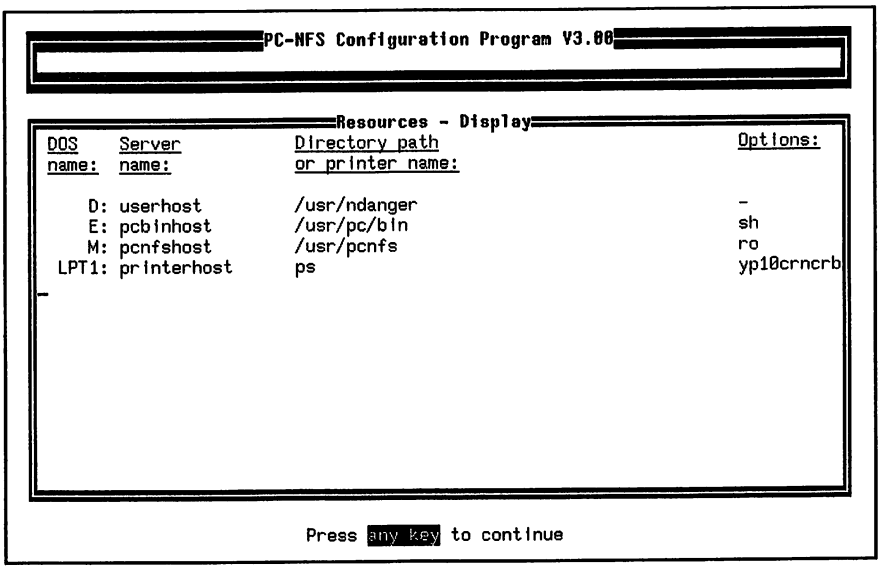
- `Resource Display`
- `Mount`
- `Dismount`
- `Modify`
- `Delete`

Remote file systems and remote printers are *network resources*. The remote file systems and remote printers you mount over time form a *resource pool*. Whenever you mount a remote file system or a remote printer, PC-NFS adds that resource to the resource pool. Within PC-NFS a remote

file systems is a *network disk* and a remote printer is a *network printer*. If you want to remount a previously used resource, you do not have to reenter it; you can just select it from the resource pool. The following sections explain each resource menu option in detail.

Resource Display

This item displays the currently mounted network resources from the resource pool. Your screen should look similar to this:



The `DOS name` column tells you on which DOS device the network resource is mounted. The next three columns taken together show you how the network resource is stored in the resource pool. The `Server name` column displays the name of network server where the remote printer or file system is located. The `Directory path or printer name` column displays the name of the network resource which can be either a remote file system or a remote printer. The `Options` column contains coded information, about file access on a network disk or further information about the network printer. The sections "*Mounting Disks*" and "*Mounting Printers*," explain the coding in detail. You can inspect and change these options using `Modify` on the `Resources` menu.

Each line of this display describes a network resource, either a network disk or a network printer, mounted on a DOS device. For example:

```
F: manhost   /usr/man                    ro
```

describes a network disk resource mounted on DOS drive F. Changing just one of these items makes a new resource. For instance:

```
F: manhost   /usr/man                    -
```

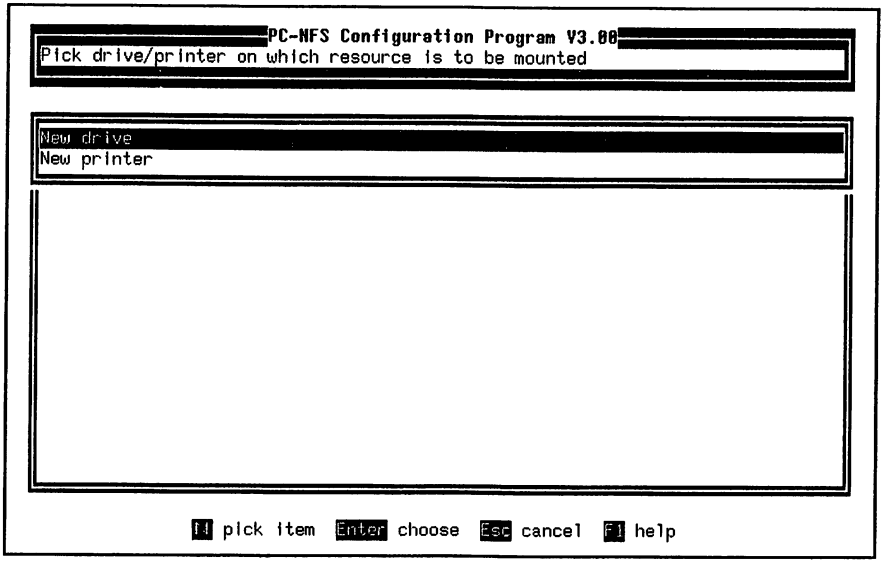
forms a new network disk with different file permissions.

If any network resource appears with a question mark (?) before it, the last attempt to mount it failed.

Mount

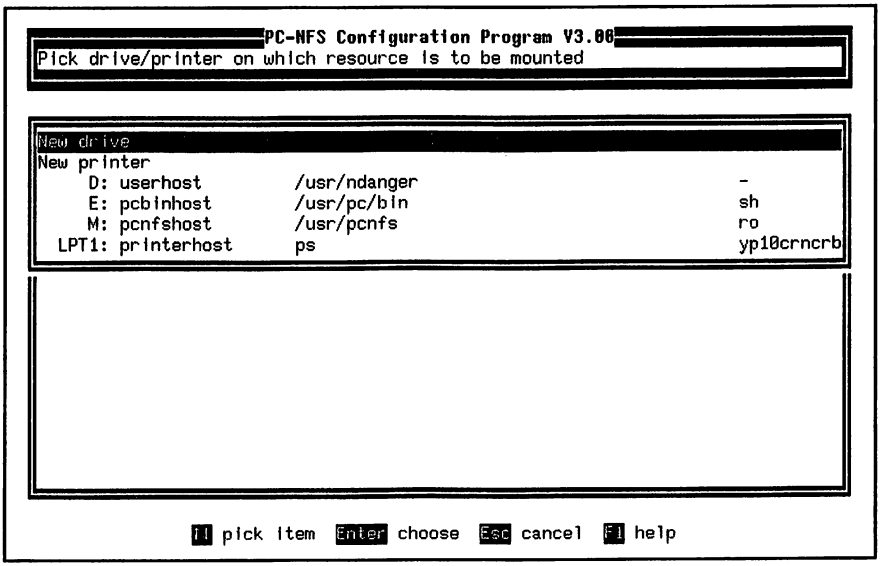
You use this menu item to mount network resources, either a network disk or a network printer, for PC-NFS. You can mount resources that have never been mounted and remount previously used resources. Select Mount by using the arrow keys to highlight Mount and press Enter.

If you are installing PC-NFS for the first time or have never mounted network resources before, the following screen appears:



You select New drive to mount a network disk on a DOS drive or New printer to mount a network printer on one of the DOS print devices LPT1, LPT2, or LPT3.

This screen appears if you have previously mounted remote devices.



At this point select the DOS disk drive you want to mount a network disk on or the DOS printer you want to mount a network printer on. You can select either a DOS device on which you have previously mounted a network resource or a previously unused DOS device.

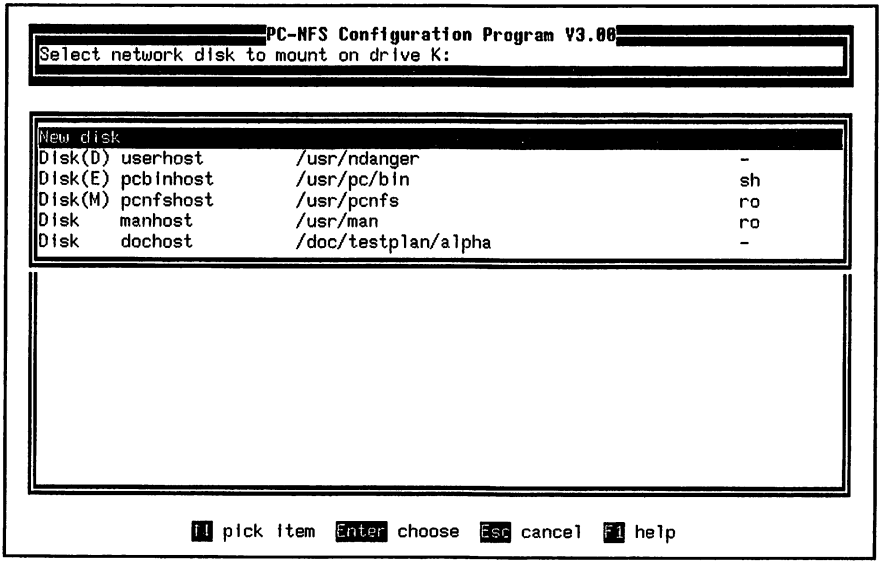
If you want to use a DOS disk drive for the first time, select `New drive`. When you select `New drive`, a new menu appears that contains all the available drives. This menu does not list drives that already have a mounted remote file system. Select the drive that you want to mount a remote file system on and press Enter. Proceed to the section, "Mounting Disks."

If you want to mount a DOS printer for the first time, you select `New printer`. When you select `New printer`, a new menu appears that contains all the available printers. You can redirect the output from DOS parallel printers `LPT1`, `LPT2`, and `LPT3` in this way. Any DOS printer that you have currently mounted a remote printer on does not appear on this menu. Select the DOS printer that you want to mount a remote printer on and press Enter. Proceed to the section, "Mounting Printers."

The items below `New printer` are the current DOS devices upon which network resources are mounted. The only items to select here are DOS drives such as D, E, F, or the DOS printers, `LPT1`, `LPT2`, and `LPT3`. The mounted resource is included in the display so you will know what you are displacing if you select that DOS device. To select a DOS device with a currently mounted network resource, highlight the device and press Enter. If you

select a DOS disk drive to mount a network disk on, proceed to the section, "Mounting Disks." If you select a DOS printer to mount a network printer on, proceed to the section, "Mounting Printers."

Mounting Disks. If you select a DOS disk drive, the screen that appears has two parts, the `New disk` menu item, and the network disks in the resource pool as shown below:



The cursor highlight `New disk` or the network resource currently mounted on the selected DOS disk drive. Select `New disk` and press Enter if you want to mount a network disk (server, path name, and options) that you have not previously mounted. If you want to mount a network disk from the resource pool, use the cursor keys to highlight the disk you want. Pressing Enter mounts the highlighted network disk on the chosen DOS disk drive creating a new network disk.

If you select `New disk`, a new menu appears with these five items:

- `Server`
- `IP address` (if your system does not have Yellow Pages)
- `Path`
- `Options`
- `Default for`

The last item, `Default for`, does not appear until you have completed the other items.

For `Server`, enter the name of the system (Host Name) where the file system you want to mount resides. If you do not have Yellow Pages, you must also supply the Internet address for the server system. For `Path`, specify the complete path to the file system you want to mount. For the path, use the syntax of the network file server. For example:

UNIX	The path begins with a slash (`/`) and directory components are separated by slashes; for example, `/usr/tmp`.
VMS®	The path may not include any slashes (`/`) or backslashes (`\`); for example, `dra:[xxx,yyy]zzz`.

The next item, `Options`, displays another pull down menu with these options:

- `No sharing control`
- `Read only access`
- `Use lock manager (if available)`
- `Use lock manager (required)`

Use the first choice, the default, if you want the files to have read and write file permissions. The second item sets read-only file permissions. The third choice uses file locking to control use of the file by more than one user at a time, if your system has file locking. You can only use the last item if your network has the lock manager capability, otherwise you receive an error message and you must reselect. Note that PC-NFS only supports advisory file locking. For further information see Chapter 7, "*PC-NFS Technical Reference.*"

Each selection here creates a code for the resource display of the disk. The four codes for file access are:

–	No sharing control for files
`ro`	read-only file access
`sh`	Use lock manager (if available) for files
`ms`	Use lock manager (required) for files

The last item, `Default for`, lets you make the current network disk the default mount for a selected DOS disk drive. If you select a network disk as the default, whenever you reboot the system that network disk will be mounted on the selected DOS disk drive. If you choose `None`, the disk drive will not boot with a default network disk mounted.

The Resource display screen appears with the network disk mounted. Press any key to continue.

Mounting Printers. If you select a DOS printer, the screen that appears has two parts, the `New printer` menu item, and the network printers in the resource pool. The cursor highlights `New printer` or the network resource currently mounted on the selected DOS printer. Select `New Printer` and press Enter if you want to mount a network printer (server, path name, and options) that you have not previously mounted. If you want to mount a network printer from the resource pool, use the cursor keys to highlight the printer you want. Pressing Enter mounts the highlighted network printer on the chosen DOS printer designation.

If you select `New printer`, a new menu appears with the following items:

- `Server`
- `IP address` (if your system does not have Yellow Pages)
- `Name`
- `Start print`
- `Printer Type`
- `Default for`

Server. For `Server`, enter the name of the system (Host Name) where the printer you want to mount is attached.

IP Address. If you do not have Yellow Pages, you must also supply the Internet address for the system to which the printer is attached.

Name. For `Name`, enter the name used on the server to identify the printer. For example, lp.

Start Print. Use `Start print` to determine when the PC-NFS print spooler, `PRT.EXE`, collects print output from your application into a single print job on the server. Normally, when you print from a DOS application, there is no way to tell when the application has finished sending output to the printer. The `Start print` option solves this problem.

Typically, DOS applications send characters to the printer one at a time, and simply stop sending characters when they are done. This works fine on a single-user PC with a local printer. However, on servers which are used by more than one person, there needs to be a way to tell when one person's output ends and another's begins; otherwise, your output might become intermingled with someone else's. Servers thus use the notion of a *print job*. They collect print jobs on a queue and print them one at a time, often preceded by header pages that identify the owner of each job. The `Start print` option allows you to decide when the PC-NFS print spooler collects all of your application's printer output into a single print job on the server.

`Start print` provides four options to signal that the entire file is ready to be printed:

- `After 5 minutes`
- `On program exit`
- `Enable printer Hot key`
- `NET PRINT only`

Choose the option that works best for you:

`After 5 minutes`

When you select this option and print, your application sends data to the print spooler. When five minutes have passed since the last data was sent to the spooler, whatever has been sent is assumed to be the entire print job. Do not use this option if your application pauses for more than five minutes while printing, or if you want to issue multiple print commands to your application and want all of the output to be printed as a single print job.

This option also causes printed output to be submitted:

- When you exit from the program you are printing from, or *any other active program.* Therefore, if you are using a multitasking system such as MS-Windows® and select this option, you should not exit any programs while printing, or you should use a different print spooling option, such as `NET PRINT only`.
- When you use the PC-NFS `net print` command.

Note: You can set the print spooler timeout to less than five minutes by changing the `PRT` parameter in your `AUTOEXEC.BAT` file, or any other file you use to start PC-NFS, as follows:

`PRT -T`*`sec`* **`*`**

where *`sec`* is the time in seconds before your print job spools. For example, `PRT -T30 *` sets the time for 30 seconds.

In most cases you will want to use this option, probably with a shorter timeout, unless there are explicit reasons not to use it.

`On program exit`

If you choose this option, PC-NFS collects printer output into a print job when you exit *any* active application. Therefore, if you are using a multitasking system like Microsoft Windows, do not exit any active programs while an application is printing, or use the `NET PRINT only` option instead. Using the Windows print spooler only adds to the confusion here; we do not recommend that you use the Windows spooler with PC-NFS. This option is most useful if you tend to exit your application when you are done printing.

`Enable printer Hot key`

If you choose this option, PC-NFS submits your printer output as a print job whenever you press the printer hot key (or, as with the other options, when you use `net print`). It gives you complete control over when your print job is submitted.

Be careful that you do not press the hot key while an application is still printing.

`NET PRINT only`

The `net print` command collects printed output into a print job, even if you have chosen another spooling option. This option disables all other spooling options and indicates that *only* the `net print` command will cause a print job. Use this option when other options cause your print output to be erroneously split up into multiple print jobs.

The following table summarizes your options:

Event / Start Print Option	5 Minutes Idle	Program Exit	Hot Key pressed	Net Print Command
After 5 minutes	yes	yes	no	yes
On program exit	no	yes	no	yes
Enable printer Hot key	no	no	yes	yes

Printer Type. `Printer Type` provides four options to match the physical printer you are using with the kind of printer the application expects:

- `Standard text`
- `PostScript®`
- `Diablo 630®`
- `Raw (unfiltered)`

`Standard Text`

Select the `Standard text` option when your application produces text without printer control codes. This mode filters most printer control codes, so that if your server has a PostScript printer with TranScript® software, the server will not reject the output as a binary file. Standard text mode can also be used if the application produces PostScript and the physical printer is PostScript, as long as the application puts a conventional PostScript header at the beginning.

`PostScript`

Select the `PostScript` option if your application produces PostScript output and the printer is PostScript. The only difference between the `PostScript` option and the `Standard text` option is that `PostScript` causes PC-NFS to put a header on the PostScript output. It will not work unless the application produces PostScript and the printer is PostScript.

`Diablo 630`

Select the `Diablo 630` option only if your application produces output formatted for a Diablo 630 printer and the printer is PostScript. In this case, PC-NFS activates a Diablo 630-to-PostScript converter on the server. If you choose this option, you must also select the printer pitch and normal and bold fonts. These items appear automatically if you select the `Diablo 630` option.

`Raw (unfiltered)`

The `Raw (unfiltered)` option causes PC-NFS to send all characters to the server. Use this option whenever the physical printer is not a PostScript printer. If your application produces printer control codes, it must be configured for the kind of printer you are using.

The following table summarizes the `Printer Name` options to use in various situations. In cases where more than one option may work, the option most likely to work is listed first:

Application Configured For	Physical Printer		
	PostScript	Diablo 630	Other
PostScript	PostScript Standard text	x	x
Diablo 630	Diablo 630	raw	x
Generic (no control codes)	Standard text	Standard text, raw	Standard text, raw
Other	x	x	raw

Default For. The last item, `Default for`, lets you make the current network printer the default mount for a selected DOS printer. If you select a network printer as the default, whenever you reboot the system that printer is mounted as the selected DOS printer. If you choose `None`, the DOS printer will not boot with a default network printer mounted.

Each selection creates a code for the resource display of the printer. The code for printers consists of a set of letters that specify information about the printer.

- The first letter tells you when print spooling occurs. The options are:

  `y` After five minutes

  `n` On program exit

  `w` Net print only

  `k` Enable printer Hot key

- The second letter identifies the type of printer emulation. The options are:

  `x` Standard text

  `p` PostScript

  `d` Diablo 630

  If the printer emulation is Diablo 630, letter code `d`, the column displays several other parameters, described later in this section.

  `r` Raw (unfiltered)

- The next two characters tell the pitch, 10, 12, or 15.

- The next three characters tell you the normal font. The code for the fonts is:

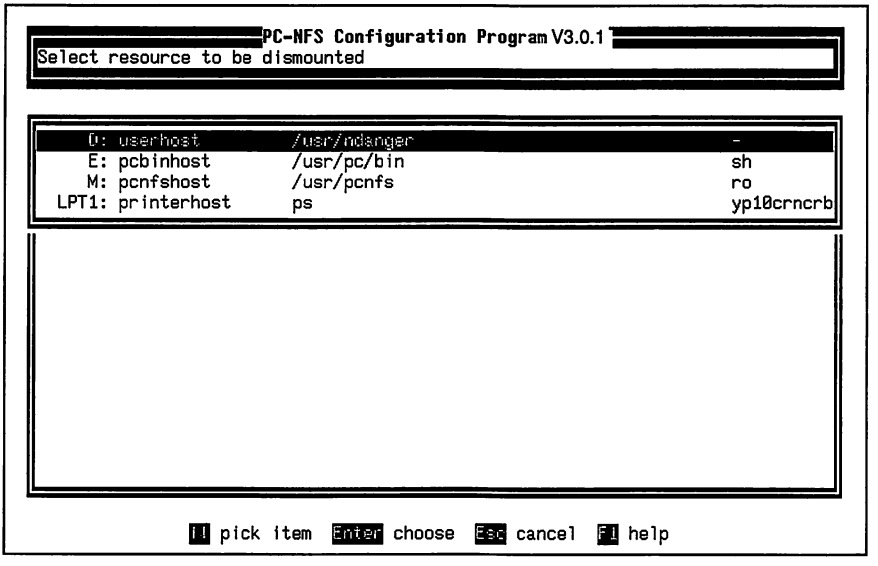
Courier	crn
Courier-Bold	crb
Courier-Oblique	con
Courier-BoldOblique	cob
Helvetica	hrn
Helvetica-Bold	hrb
Helvetica-Oblique	hon
Helvetica-BoldOblique	hob
Times-Roman	trn
Times-Bold	trb
Times-Italic	ton
Times-BoldItalic	tob

- The next three letters describe the bold font, using the scheme above. For example, suppose you want to emulate a Diablo 630 using 10 pitch with Helvetica-Bold as the normal font and Courier-BoldOblique as the bold font printing `On program exit`. The coding that appears is:

```
nd10hrbcob
```

Dismount

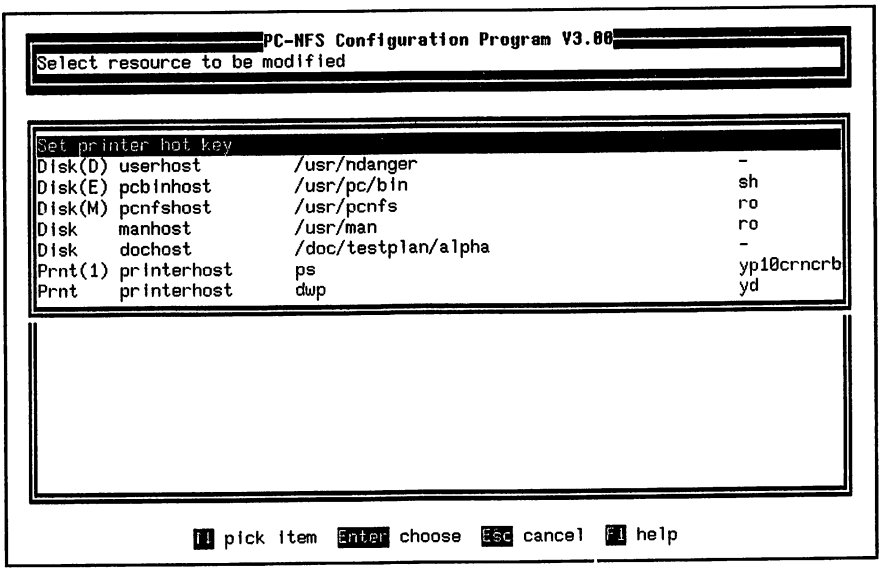
To dismount either a remote file system or printer, select `Dismount`. The following screen appears:



All the mounted network resources appear on this screen. Highlight the resource you want to dismount and press Enter. The Resource display screen appears with the resource dismounted. Press any key to continue.

Modify

You use this menu item to change any of the parameters of any network resource that is, or has been mounted, and to configure the printer Hot key. When you select `Modify`, the following screen appears:



The next section discusses the printer Hot key. If you want to change some aspect of the mounting of a device, proceed to the section, "Modifying Network Disks and Printers."

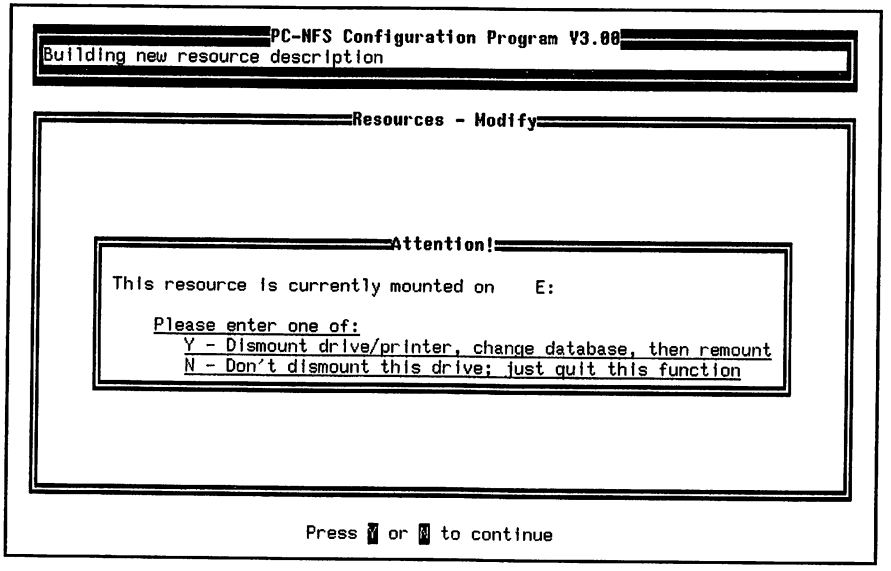
Hot key. If enabled, the printer Hot key forces your printer output to be printed. You enable the printer Hot key when you mount a printer. (See the section, "Mounting Network Printers," for more information on mounting printers.)

The default printer Hot key is Alt P. If you want to change the key sequence you use for the Hot key, select `Set printer Hot key`.

Changing the Printer Hot Key. The Hot key can be any single character, but that character is not available to you while using another application, such as word processing. For this reason, the Hot key is typically a combination of any key and either Shift, Alt, or Ctrl. For example, if you want your printer Hot key to be Ctrl Z, press Ctrl and hold it down while you press Z. To complete the choice, press Enter.

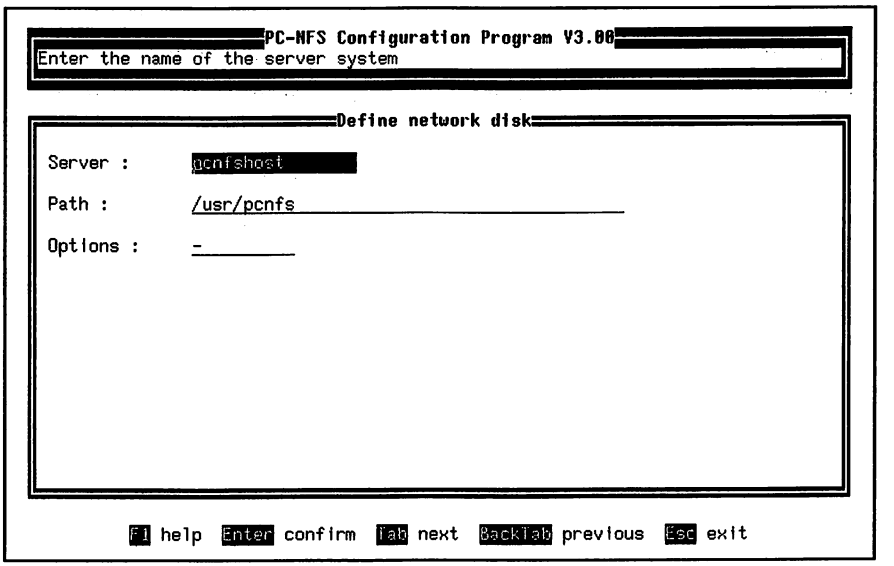
Modifying Network Disks and Printers. Use the arrow keys to highlight the network resource you want to modify and press (Enter). Note that the entire resource pool is available. You can modify mounted and unmounted resources.

If you select a currently mounted resource, the following screen appears after you make your changes:



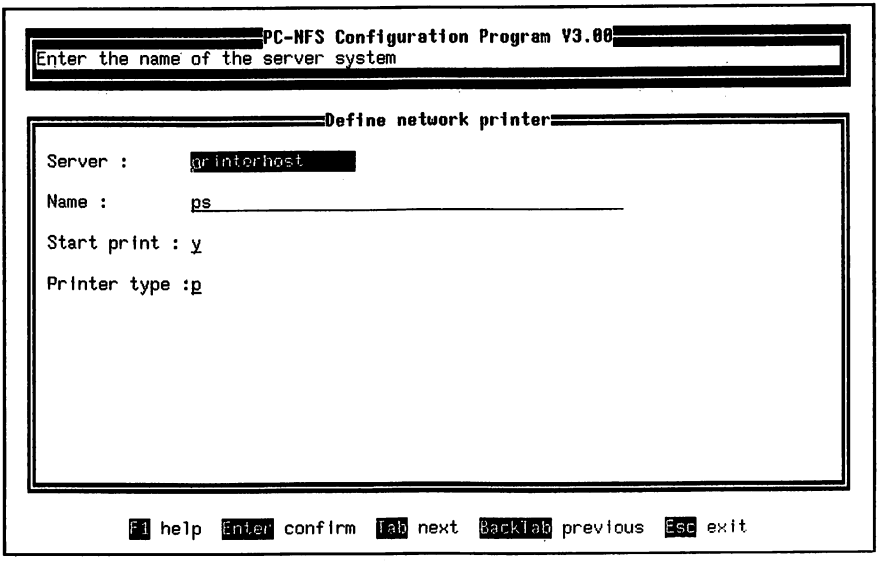
If you want to modify the resource, enter (Y). If you do not want to modify the resource, enter (N). If you choose to proceed, PC-NFS dismounts the resource, updates the resource pool information, and remounts the resource on its default device.

When you select a disk, the following screen appears:



Use Tab and Shift Tab to move from field to field and the right and left arrow keys to move the cursor within a field. Make the edits you require and press Enter in the `Default for` field to complete the edit.

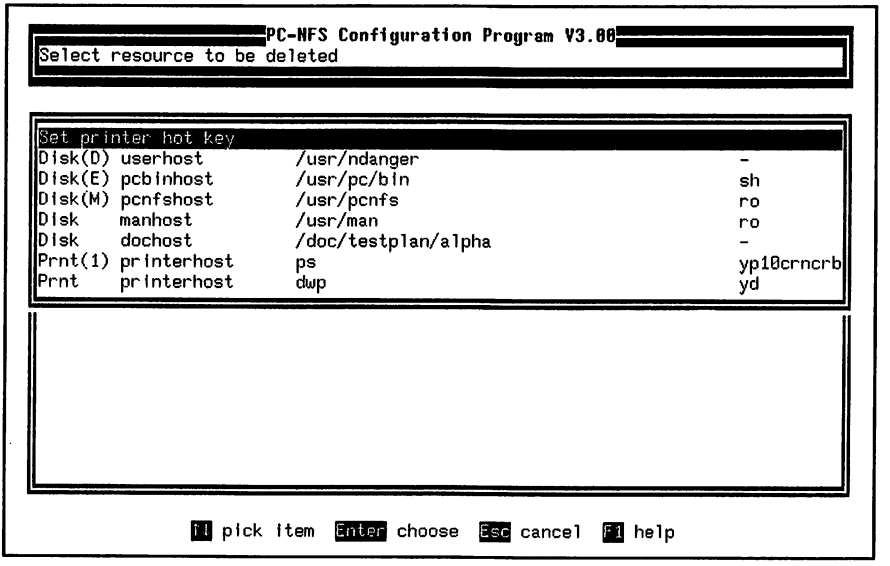
When you select a printer, the following screen appears:



Use Tab and Shift Tab to move from field to field and the right and left arrow keys to move the cursor within a field. Make the edits you require and press Enter in the `Default for` field to complete the edit.

Delete

When you select `Delete`, a screen showing the resource pool appears:



Use the arrow keys to highlight the resource you want to delete and then press Enter. You see the prompt:

```
Are you sure that you want to delete this resource?

        Please enter one of:
          Y - I really want to do this
          N - Oops - forget this command
```

If you want to delete the resource, enter Y, otherwise enter N. The screen pauses for a moment while the resource pool is rewritten and then the resource display appears. Press any key to continue.

Networks

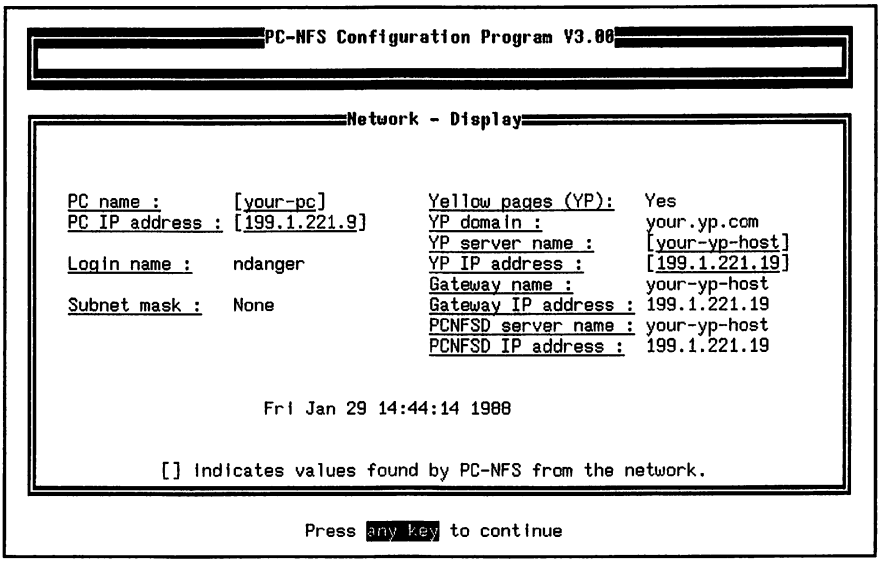
There are three options available for the Network menu item:

- Network display
- Direct connect
- Dial-up

Each option is explained in detail in the following sections.

Network Display

This item displays the current network environment. Your screen should look similar to this:



There may be some items that appear in brackets on the display. These values were found by PC-NFS from the network.

Direct Connect

A directly connected system is a system that is physically connected to a network by a cable. This selection sets the configuration for directly connected networks, whether Ethernet or serial. Use the Configuration Form completed by your system administrator to fill in the form questions.

The first screen has five form questions. Your answers to the last two questions determine the next screen that appears.

`Timezone:`
Choose your time zone from the menu using the arrow keys to make your selection, and press Enter.

`Daylight Savings Time?(Y/N)`
Answer `Y` for yes if your area observes daylight savings time.

`Yellow Pages?(Y/N):`
Yellow Pages is a service that maps the names of host systems to their Internet addresses. An Internet address is a number that uniquely identifies a system on a network. If your network has Yellow Pages, PC-NFS can use the Yellow Pages services to look up the addresses of the systems you want to use, instead of you having to supply them. If your system has Yellow Pages, answer `Y` for yes.

`RARP?(Y/N)):`
RARP, or *Reverse ARP*, is a service that your PC can use to find out its address from the network.

The next several sections describe the screens that can appear, depending on your answers to the questions above. You only need to consult the section that describes your answers to these questions. The last question on each screen is:

```
Advanced questions? (Y/N)
```

If you answer yes (`Y`) to this question you can change several non-essential parameters for PC-NFS. In general, the items allow you to override assumed default values. For further information turn to the section, "Advanced Questions," later in this chapter.

Both Yellow Pages and RARP. If you have Yellow Pages and RARP, the PC-NFS configuration program can do most of the work for you. You need to tell it:

`Yellow Pages Domain Name:`
This is the name given to the group of systems and users in the Yellow Pages database.

Yellow Pages and no RARP. If you have Yellow Pages, but no RARP, you need to supply the Yellow Pages domain name. You also must supply your PC's name and Internet address:

`PC Name:`
Enter the name your PC is known by on the network.

`IP Address of PC:`
Enter the Internet address for your PC.

`Yellow Pages Domain Name:`
This is the name given to the group of systems and users in the Yellow Pages database.

No Yellow Pages. If you have RARP, but no Yellow Pages, you need to supply the PCNFSD server name and IP address and your PC name and IP address:

`PC Name:`
Enter the name your PC is known by on the network.

`IP Address of PC:`
Enter the Internet address for your PC.

`PCNFSD Server Name:`
The `PCNFSD Server` is the system where the server software that supports PC-NFS resides. Enter the name of that server here.

`IP Address of PCNFSD Server:`
Enter the Internet Address for the system where the PC-NFS server software resides.

Advanced Questions (optional). The questions that appear on this screen vary according to your answers to the questions on the first screen. With each question is an indication of when the question will appear. Some items may have a value in brackets to the right. This value is the value PC-NFS found over the network. It is there for reference only.

`User name:`
Enter the name you use to log in to your network.

`YP server name:`
The YP server is the system where Yellow Pages reside. Enter the name of that server here. This question appears only when you have answered yes to the Yellow Pages question.

`IP address of YP server:`
Enter the Internet address for the system where Yellow Pages reside. This question appears only when you have answered yes to the Yellow Pages question.

`PCNFSD server name:`
The `PCNFSD Server` is the system where the server software that supports PC-NFS resides. Enter the name of that server here. This question appears here only when you have answered yes to the Yellow Pages question. If you leave this question blank, PC-NFS will look for the PCNFSD server name on your Yellow Pages server.

`Gateway Name:`

A *gateway* is a system that links networks together. If you have a gateway system, enter the name here. This question always appears, unless you are using a serial port or a SunIPC.

`IP Address of Gateway:`

Enter the Internet address of your gateway system here. This question always appears, unless you are using a serial port, a SunIPC, or you have Yellow Pages.

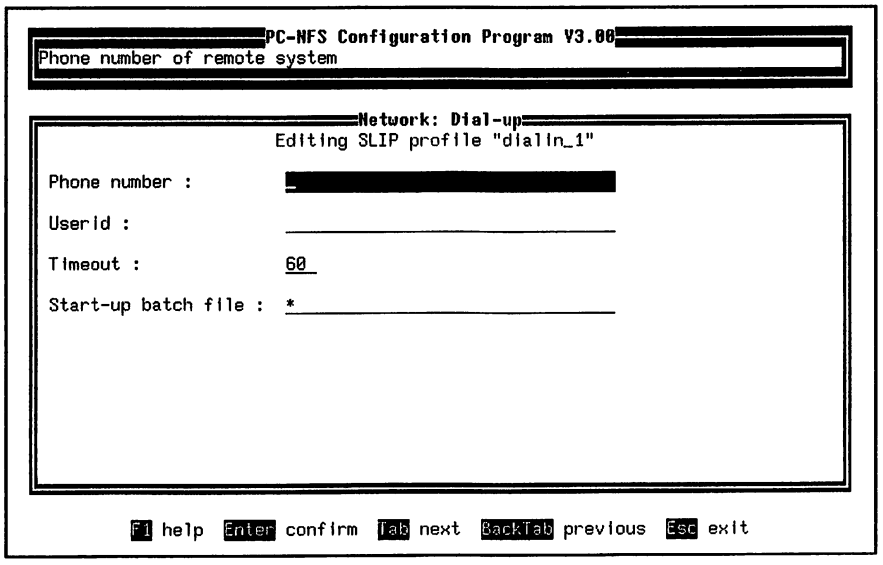
`Subnet Mask:`

The method used to separate the two parts of the host name in a subnet. This question always appears.

Dial-up

This selection sets the configuration for serial connections, using a modem over a phone line. Use the arrow keys to select `Dial-up` and press Enter.

PC-NFS dial-up serial configuration first asks you for the name of the dial-up profile you want to configure. If you have created other profiles for serial support, the PC-NFS Configuration program displays them in a menu. You can add a new profile by filling in the line `Configure System:`, or you can change an existing serial configuration by selecting the system from the menu.



When you complete the dial-up profile, the PC-NFS configuration screen displays the following questions:

`Phone number:`
Enter the phone number of the system you're dialing in to. If you're using a Hayes modem, you can use hyphens in the number. Check the specification of the modem you are using for specific dialing instructions.

`User id:`
Enter your login name here.

`Password:`
Enter your password here. Enter * (asterisk) if you want PC-NFS to prompt you for your password.

`Timeout:`
Enter the length of time, in seconds, that you want to allow before your connection times out. Enter the length of time in seconds. The default entry is 30 seconds.

`Start-up batch file:`
Enter the name of the batch file you want PC-NFS to use for start-up.

Every serial connection must follow a *dialog*. The format of a dialog is:

<expect1> <send2> <expect2> etc.

Words are separated by white space, that is, spaces or tabs. Within a <send> string you can include the following escapes:

`\n`	send a newline
`\r`	send a carriage-return
`\s`	send a space
`\b`	cause a short "break" on the line
`\t`	send a tab
`\1-\9`	pause the indicated number of seconds
`\xXX`	send the character whose hex code is XX
`$u`	send the user id
`$p`	send the password
`$s`	send the dialog name
`$n`	send the phone number
`$$`	send a "$" character

A <send> string is normally followed by a carriage return. To suppress the carriage return, end the <send> string with a backslash. For example, if the user id is "xyz", a send string of:

```
AB$uCD
```

would send the characters:

```
'A', 'B', 'x', 'y', 'z', 'C', 'D', <CR>
```

while

```
AB\2C\
```

would send

'A', 'B', *[pause 2 seconds]*, 'C'

The last <expect> string must be "SUNSLIP". Once this is received, the `connect` program gathers the network configuration information from the server and starts PC-NFS.

The default dialog is:

```
ogin: $u ssword: $p % \2/etc/sunslip SUNSLIP
```

It translates to:

EXPECT:	`ogin:`	expect the end of a "`login:`"
SEND:	`$u`	send the user id
EXPECT:	`ssword:`	expect the end of the password prompt
SEND:	`$p`	send the password
EXPECT:	`%`	expect the UNIX prompt "`%`"
SEND:	`\2/etc/sunslip`	wait 2 seconds, then run `/etc/sunslip`
EXPECT:	`SUNSLIP`	wait for sunslip's synchronization message.

If this dialog in some way conflicts with your network or system configuration you must edit the dialog which is in the file `\nfs\slipconf.db`. A typical `slipconf.db` may contain the following entries:

```
system1 9-212-555-9876 nfstest * 60 * Y
system2 9-5559876 nfstest * 60 * N atdt$n NNECT \2 ogin: $u
ssword: $p } /usr/etc/sunslip SUNSLIP
```

Note that the first a dialog contains a `Y` after `* 60 *` and the second contains an `N`. The first dialog is the default dialog, and the second is a customized dialog. All customized dialogs must contain an `N` in this position.

Beginning a Dial-up Serial Session

To begin a serial session of PC-NFS, type:

```
C>connect <profilename>
```

where *profilename* is the name of a profile you created by the procedure described above.

When you have completed your serial session, type:

```
C>hangup
```

The `hangup` command disconnects you from the host system.

Connections

If you want to change the communications board you use to run PC-NFS use the arrow keys to move to `Connections`. If you are changing from an Ethernet board to a serial configuration or vice versa, you must supply a new PC and server name for serial use. See your system administrator if you have questions. The system administrator must supply the new name for the serial server connection.

To specify whether you want to configure an Ethernet board or a serial board, highlight the appropriate choice and press Enter.

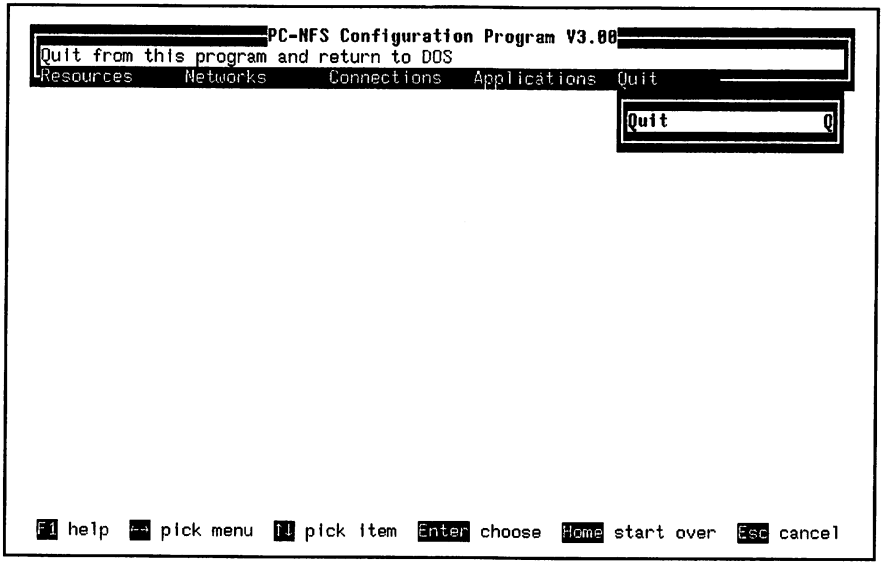
PC-NFS Connections configuration asks you to specify the drive where you will load the PC-NFS distribution diskettes. From this point on, it is identical to the PC-NFS installation program.

Applications

If you have PC-NFS LifeLine, you can configure LifeLine Mail and Backup from the PC-NFS Configuration program. See the *PC-NFS LifeLine User's Manual* for information about configuring LifeLine Mail and Backup.

Quit

If you want to end your configuration session, use the arrow keys to highlight `Quit`. The following menu appears:



If you select `Quit` you get the following prompt:

```
Do you want to quit from this program and return
to DOS?

        Please enter one of:
          Y - I really want to do this
          N - Oops - forget this command
```

If you select (Y), the program ends and the DOS prompt reappears. If you select (N), the main configuration menu reappears.

Tailoring Your System

3

The PC-NFS installation and configuration programs allow you to set up and change your PC-NFS environment. However, if you are an advanced user, you may want to change your PC-NFS configuration by altering its databases directly. This chapter is a technical reference for PC-NFS configuration. It describes the PC-NFS installation and configuration programs and the files and databases they use. The final section of this chapter describes a way to improve your environment if you have a diskette-only system.

PC-NFS Databases

The databases that PC-NFS accesses fall into two categories. There are databases that the installation and configuration programs create and maintain. There are also databases that you or your system administrator create and maintain. Sample files appear on the PC-NFS distribution diskettes for these files. Tables 3-1 and 3-2 list the names of these databases and identify the data contained in them.

If Yellow Pages services are available on your network, you can use the associated databases on the Yellow Pages server. Where the Yellow Pages is not available, PC-NFS uses local databases that it creates (those in Table 3-2) to supply information about your network.

Where Yellow Pages is not available, PC-NFS uses the information in `\NFS\HOSTS`, `\NFS\SERVICES`, and `\NFS\PASSWD`. Other application programs you can buy might use the other databases.

Table 3-1 *PC-NFS Installation and Configuration Databases*

Database	Dir	Data
CONFIG.SYS	\	PC-NFS drivers
AUTOEXEC.BAT	\	PC-NFS environment information and startup commands
NETWORK.BAT	\NFS	Network interface and commands
DRIVES.BAT	\NFS	Network drives configuration
LPCNF0	\NFS	Printer LPT1
LPCNF1	\NFS	Printer LPT2
LPCNF2	\NFS	Printer LPT3
LPCNF3	\NFS	Printer Hot key
SLIPCONF.DB	\NFS	Serial dial-up profiles
HOSTS	\NFS	Names and IP addresses of hosts on network
RESPOOL	\NFS	Resource pool entries

Table 3-2 *Other Databases*

Database	Dir	Data
SERVICES	\NFS	Names of available network services, such as telnet or ftp
ETHERS	\NFS	Ethernet addresses and associated host names
NETWORKS	\NFS	Names of networks
NETGROUP	\NFS	List of network groups
PASSWD	\NFS	User passwords
PROTOCOLS	\NFS	Name and information about protocols
RPC	\NFS	RPC program numbers and aliases

If you have Yellow Pages, you do not need the files shown in Table 3-2. If you do not have Yellow Pages consult your system administrator to help you set up these files.

The PC-NFS installation and configuration programs interact with the databases in Table 3-1. The installation program only affects the `CONFIG.SYS` and `AUTOEXEC.BAT` databases. Table 3-3 identifies the databases that configuration (`nfsconf` program) menu items interact with.

Table 3-1 *Configuration Database Interaction*

Database	Resources		Network		Connections
	Disks	Printers	Direct	Dial-up	
CONFIG.SYS			yes	yes	yes
AUTOEXEC.BAT			yes	yes	
NETWORK.BAT			yes		
DRIVES.BAT	yes	yes			
LPCNF0		yes			
LPCNF1		yes			
LPCNF2		yes			
LPCNF3		yes			
SLIPCONF.DB				yes	
HOSTS	yes	yes	yes		

The next several sections give more details about selected databases from Table 3-1 *PC-NFS Installation and Configuration Databases.*

CONFIG.SYS

If you are using PC-NFS with a serial adaptor, the installation program places the port and baud rate in this file.

This file also contains lines for several PC-NFS drivers. It always contains `PCNFS.SYS` and `SOCKDRV.SYS`. If you are using a serial board, the file contains the `SLIP.SYS` driver. If you are using an Ethernet board, it contains a *boarddriver*`.SYS` driver. If the Ethernet board is a 3COM board, there are other drivers in the `CONFIG.SYS` file.

Some configuration parameters cannot be set through the PC-NFS installation program. If you need to change these, use your favorite editor to edit this file. The tunable parameters are specified at the end of the lines:

```
DEVICE=C:\NFS\PCNFS.SYS
DEVICE=C:\NFS\3C501.SYS
```

Each option is given in the form /*<letter><integer>*. You must include a space before the first option and spaces between additional options.

You can use the following options for:

```
DEVICE=C:\NFS\PCNFS.SYS
```

`/f`*n* Set the maximum number of simultaneous open files to *n*. This must not be bigger than 127 or the results are unpredictable. The default value is 8.

`/i0` Disable incoming Internet datagram fragment reassembly. This saves about 4kb of memory. Unless you are working across an Internet router such as *SunLink-INR*™, this will not cause problems — PC-NFS never requests more data than will fit in a single Ethernet packet. Do *not* disable if you are using a serial port connection.

`/b`*n* Set the broadcast IP address to *n*, where *n* can be 0 (for all 0's, i.e. 128.15.0.0.) or *n* can be 1 (for all 1's, i.e. 128.15.255.255).

`/l`*n* Set the number of PC-NFS lock table entries to record all concurrently-active byte-range locks. The default is 16 entries. You should not specify more than 64 entries.

`/r`*n* Set the retry counter to *n*. This is the number of times PC-NFS will retry a request before giving the message "`Abort, Retry, Ignore?`" The default value is 4. A value of 0 means "retry indefinitely."

`/s` Enable space significance in file names. Do not use this switch if you run IBM PC-DOS®. Use this switch for full compatibility with Compaq DOS 3.1 and other DOS versions.

`/t`*s* Increase the network time-out for utilities by *s* seconds. A value of 0 for *s* sets the value for infinite retries. If you ever get the DOS error "`Not ready error reading drive`," then try setting this network time-out for utilities to 0.

`/x` Configure PC-NFS for serial operations. This value is normally set by the PC-NFS `install` or `nfsconf` programs.

Different settings are available for these Ethernet communications boards. You can use the following options for:

```
DEVICE=C:\NFS\3C501.SYS
DEVICE=C:\NFS\NI5010.SYS
DEVICE=C:\NFS\NIC.SYS
DEVICE=C:\NFS\NFSVEC.SYS
DEVICE=C:\NFS\WD8003E.SYS
```

`/i`*n* Set communications controller interrupt number to *n*, a number between 2 and 7. The default value is 3 for the 3C501, 3C503, and the NI5010 controllers, and 2 for the NIC controller and the WD8003E controller

`/mn` Set communications controller (NIC and Western Digital) shared memory address to *n*, a five-digit hexadecimal number. The default value is D0000 for both boards.

`/pn` Set communications controller (not valid for NIC) I/O port address to *n*, a three-digit hexadecimal number. The default value is 300.

Note that you can also set the values for `/in`, `/mn` and `/pn` by running the PC-NFS `install` program or `nfsconf`.

The 3C503 board has the following additional parameters:

`/dn` Set communications controller DMA value to *n*. The default value is 1.

`/tn` Set communications controller cable type to *n* which is either 1 or 2. A value of 1 is thin and a value of 2 is thick. The default value is 1.

AUTOEXEC.BAT

The installation program modifies your `AUTOEXEC.BAT` file so that PC-NFS starts up when your computer starts up (boots up). It adds the following lines:

```
SET TZ=xxxxxxx
SET NFSDRIVE=xx
PRT *
NFSRUN
```

The first line sets the time zone, the second sets the NFS drive where PC-NFS looks for its database files, the third starts the PC-NFS print redirector, and the last runs the network. If you are upgrading from a previous release, your network commands now reside in `NETWORK.BAT`. The `nfsrun` program runs commands from `NETWORK.BAT` and `DRIVES.BAT`.

The installation program also adds `\NFS` to your path or creates a path with `\NFS` if none exists.

Cautions. If you use environment commands, such as `path` or `set path`, they must appear in `AUTOEXEC.BAT`, not in `NETWORK.BAT`. If you have environment commands that refer to devices mounted by PC-NFS, these commands must follow the `nfsrun` command.

If you are upgrading, and have PC-NFS commands inside conditional statements in `AUTOEXEC.BAT`, you must manually alter `AUTOEXEC.BAT` for the new version. Otherwise, the PC-NFS install program moves all `net use` commands to `DRIVES.BAT` and the file listed in the next section to `NETWORK.BAT`. This may leave the `AUTOEXEC.BAT` file with incomplete conditional statements.

NETWORK.BAT

This database may include some or all of the following PC-NFS commands:

`NET YPDOMAIN`	Sets the Yellow Pages domain name
`NET START RDR`	Starts the network
`NET YPSET`	Sets the Yellow Pages server
`NET PCNFSD`	Sets the `pcnfsd` server
`NET ROUTE`	Sets the gateway system
`NET NAME`	Sets the user name
`NET SUBNET`	Sets the subnet mask

DRIVES.BAT

Contains `net use` commands that mount printers and drives.

LPCNF0, LPCNF1, LPCNF2, LPCNF3

These databases contain printer configuration information and should not be modified by hand. Use the configuration program to make any changes.

SLIPCONF.DB

This file contains information about remote hosts you can dial up, including the dialog you use to connect to the host system if you are using a dial-up serial connection.

HOSTS

The `HOSTS` file contains server and Internet address pairs which are used if you do not have Yellow Pages.

Using Diskette-Only Systems

On a diskette-based system, an NFS server can supply all the files you need during normal use. In most cases, PC-NFS supplies much faster disk access than diskettes on the PC itself. Therefore, you might want to arrange to use a PC-NFS disk as your "system" disk. To do so, you must set up a suitable disk configuration and then edit your `AUTOEXEC.BAT` file. The following steps illustrate this procedure. (These instructions assume that you have performed a diskette-only installation of PC-NFS as described in Chapter 1, and that you have booted up off this diskette in drive `A`.)

1. Choose a directory in a suitable file system on your NFS server — for example, your home directory. The following example uses `/usr/xyzzy` on server `adventure`.
2. Mount this directory using `nfsconf`. This example mounts the directory on drive `S`.
3. Create a new subdirectory in this directory to use as your PC-NFS system drive:

```
A>S:
S>MD NFS
S>CD NFS
```

4. Insert the PC-NFS Installation diskette and copy all the files:

```
S>COPY A:\*.*
```

   Repeat for each PC-NFS distribution diskette. Do not copy the files from the Server 1 and Server 2 diskettes.

5. Copy the existing `pcnfs.sys` file from its current directory.
6. Edit the `AUTOEXEC.BAT` file to look like this:

```
SET PATH=A:\;A:\NFS
PRT *
SET TZ=EST5EDT                  <<your time zone>>
NFSRUN
SET NFSDRIVE=S
SET PATH=S:\;S:\NFS
SET COMSPEC=S:\COMMAND.COM
S:
```

7. Reboot your system. Once you have rebooted, you can remove the PC-NFS diskette from the drive until you boot again.

Note that if you run `nfsconf` after drive `S` has been made your network drive, all updates are made to the database and configuration files on drive `S`. If you want these changes (such as network configuration or connections configuration) to be active at boot time, you must copy these files to the boot disk.

If you want the resources you configure to be mounted automatically at boot time, add the following line to the end of your AUTOEXEC.BAT file:

```
drives
```

This mounts the drives which you configured using `nfsconf`, using the `\NFS\DRIVES.BAT` file on drive `S`.

Installing PC-NFS on a Non-Bootable Disk or Partition

The PC-NFS installation program assumes that you are installing onto a bootable disk. If you want to install onto a non-bootable hard disk or a non-bootable partition of a hard disk, follow this procedure:

1. Install onto the destination disk.
2. Run `nfsconf`.
3. Reboot the system.
4. Copy the `CONFIG.SYS` file from the destination disk onto your boot disk. If you already have a `CONFIG.SYS` file on your boot disk, merge the two files.
5. Copy the `AUTOEXEC.BAT` file from the destination disk onto your boot disk. If you already have an `AUTOEXEC.BAT` file on your boot disk, merge the two files.
6. Reboot your system.

NFS Server Issues

4

This chapter addresses system administrator of NFS server systems, people who may be known at your site as the network administrator, system manager, or system guru. If you are not that person, please make that person also reads this.

These are the tasks for the system administrator:

1. Answering the questions on the PC-NFS Configuration Form
2. Updating the network databases to admit a new system, just as you would when adding any new machine to the network. (If there is no Yellow Pages service on the network, you must update local databases instead.)
3. Installing the network support software, `pcnfsd`, optionally, the locking services support software, `rpc.lockd` and `rpc.statd`, and also, optionally, the serial software if any users are using the serial connection.

Of these tasks, the first is explained in the Configuration Form. The second is explained in your NFS server documentation. If you are installing PC-NFS on a Sun network, see the section *Adding PC-NFS to Your Sun Network* at the end of this chapter. The focus of this chapter is on the third task: installing the PC-NFS support software, the `pcnfsd` program, and the locking services support software, the `rpc.lockd` and `rpc.statd` programs.

PC-NFS provides its basic file-sharing capabilities without requiring specialized server-side software or management procedures. When PC-NFS users only need generally-accessible exported file systems and do not need spooled printer services, your involvement with PC-NFS can be limited to issuing network addresses and host names. Since several useful features of PC-NFS depend upon specific server support, however, you should seriously consider installing `pcnfsd` even if your initial clients do not need it.

If your server supports locking services, you may wish to install PC-NFS locking services software to allow your PC-NFS users to use locking services as well.



Installing pcnfsd

This section explains how to install and maintain the PC-NFS support software that runs on server systems. The support software consists of a single program, pcnfsd, that provides:

- Access to printer spooling services
- Authentication, a way to recognize individual users and assign them different privileges.

Since user authentication and spooling services are optional, users can perform many PC-NFS functions without having pcnfsd installed and running on server systems.

Sun and Other NFS Servers

NFS is available from a variety of vendors and on a range of systems, and pcnfsd procedures differ somewhat depending on the NFS server hardware and software. Since it is not possible to predict what kind of servers are in use at your installation, the material in this chapter ranges from specific directions for well-known situations to general guidelines for adapting software and procedures to your local environment.

Binary and Source pcnfsd

Because PC-NFS can be used with a variety of file servers with different architectures and operating systems, it is impractical to supply binary versions of pcnfsd for each potential server. For this reason, Sun supplies pcnfsd in a single binary version that runs on Sun-2™ and Sun-3™ systems, and in C source code for other Sun or non-Sun systems. If your server system is not a Sun, adapt the source code as necessary for your system and then compile and install the modified version. This is discussed further in the section *Installing pcnfsd – The Procedure*.

Adapting pcnfsd to non-Sun environments requires some understanding of what the program does and how it interacts with other software on the server system. This chapter thus begins with a description of what pcnfsd does. Guidelines for porting the program are based on this discussion.

Installation on Sun NFS servers is a simpler case. If you want to install the pcnfsd support software on a Sun file server, turn to the section *Installing pcnfsd – The Procedure* and follow the procedure described there. For a deeper understanding of how the software works, read the next few sections.

Why pcnfsd Exists

pcnfsd exists because the DOS operating system does not offer the richness of the NFS file system environment. While PC-NFS has been designed to provide its essential functions without special arrangements on the NFS server side, DOS prevents full use of the network resources available. The following sections explain why pcnfsd is necessary to broaden the range of options available to DOS users.

The Purpose of pcnfsd

pcnfsd is a program that runs continuously on a server system in order to service PC-NFS requests for user authentication and print spooling. The server system usually activates pcnfsd at system startup. pcnfsd uses Sun's Remote Procedure Call (RPC) facility to perform system operations on remote systems.

In UNIX environments, such continuously-running service programs are called *daemons*, hence the *d* in the program name pcnfsd. In most UNIX systems, daemons are initiated by the /etc/rc.local file.

The following sections discuss the two functions of pcnfsd. This discussion is slanted towards a UNIX environment; for other systems, consult the documentation for your NFS implementation to determine how the UNIX-like concepts in NFS are represented in your system.

User Authentication

The authentication capabilities of pcnfsd enable you to monitor system resources more effectively, and to increase your choices for system security. See the net name command in the *PC-NFS User's Manual* to see how this is done.

Anyone on a PC that has PC-NFS installed can access NFS servers, with nobody privileges. Using the net name command, a PC-NFS user can log in to PC-NFS in much the same way as the user can log in to a UNIX system or a VMS system. The net program takes the user name and password, encrypts them, and calls the authentication procedure in pcnfsd on the system that is the current authentication server. This procedure either succeeds, and returns a *user id* and a *group id* to be used in constructing the credentials for the user, or it fails, indicating that the name and password are unacceptable

Resource Use and nobody. From the system administrator's perspective, universal use of `nobody` privileges is less than ideal. Under these circumstances, accounting for disk space use becomes impossible. All PC users' files show up as owned by `nobody`, and there's no way to tell who's really using which resources.

System Security. You can use the `net name` command to establish a *user id* and increase the DOS user's options in restricting file access. With unique *user ids*, individuals can determine who can inspect, modify, and execute their files. *User ids* do not enhance the server's security, but they do give you more options.

> **Sun is working on secure RPC protocols. When these become available, they will be incorporated in PC-NFS.**

You should also be aware that PC-NFS poses the same security problems as other network functions that are built on RPC. For password checking, the encryption employed by `net name` is trivial. This checking is intended to deter only those users who are casually scanning network traffic. Therefore, it is important for the system administrator on each system to exercise tight control over the installation of RPC programs.

Printing

PC-NFS achieves print spooling using normal NFS file operations. When the user redirects a DOS printer to a printer on a file server with the following command:

```
A>net use lptn:
```

the `net` program calls `pcnfsd` to find out where to place spool files. As distributed, `pcnfsd` creates a directory with the path name *argument*`/`*client*, where

argument is a value from the command line that starts `pcnfsd`. *argument* must identify a directory on a file system that is exported with no access restrictions; a typical choice is `/usr/tmp`.

client is the host name of the client PC.

PC-NFS takes the name of the spool directory and mounts an NFS virtual drive on it. It then creates spool files in that directory. When it determines that a file is to be printed, it calls `pcnfsd` with:

- the name of the file to be printed
- the name of the logged-in user on the PC
- the name of the printer to be used.

`pcnfsd` then invokes the local spooler to print the file.

PC-NFS maintains a spool file "ready and waiting" whenever a printer is redirected. This might result in a number of zero-length files being left in the PC-NFS spool directories. You should add an entry to `/usr/lib/crontab` to clear these out at regular intervals; for example:

```
0 4 *** find /usr/tmp -atime +1 -type f -exec rm {} \;
```

Systems That Need to Run `pcnfsd`

You must run `pcnfsd` on every system that performs user authentication services and every system to which you want to spool print files. If you use Yellow Pages, you should run `pcnfsd` on all Yellow Pages server systems, master and slave alike. (Since PC-NFS can pick any of the Yellow Pages servers as the default server, a copy of `pcnfsd` must run on each server.)

If running `pcnfsd` on all Yellow Pages servers is impractical, add a `net pcnfsd` command to each PC's `AUTOEXEC.BAT` file to force PC-NFS to use a specific server.

Because `pcnfsd` simply invokes the standard print spooling subsystem, it can be used with remote printers. Say, for example, you have two network file servers:

- `diamond`, a Sun 3/170 system, and
- `emerald`, a DEC VAX running 4.2BSD UNIX with a printer named `dpp` available on it.

You can set up a `/etc/printcap` entry on `diamond` to read:

```
dpp:lp=:rm=emerald:sd=/usr/spool/dpp
```

PC-NFS clients can then use the printer `\\diamond\dpp`, and their print jobs will be routed to `emerald`.

You can use this capability to make printers accessible to PC-NFS clients even though the printers are attached to servers that are not running `pcnfsd`. Therefore, you don't have to port `pcnfsd` to systems in order to gain access to their locally attached printers.

PC-NFS Server Installation

Installing pcnfsd

The source for pcnfsd distributed on the PC-NFS 3.0.1 distribution diskette Server 1 is r_pcnfsd.c. Before installing it, check your server to see if pcnfsd (usually called rpc.pcnfsd) is already present. If it is not, install it as described below. Note that these procedures apply only to Sun systems. For other systems it may be necessary to modify the source code or installation procedure. Consult your server system documentation for details.

If pcnfsd is not already installed (as it is on the Sun386i system, for example), you can install it in two ways. In most cases, you want to install pcnfsd so that it is started by the inetd "superdaemon." If, however, you want to use a spool directory other than the one created by inetd (/usr/spool/pcnfs), you should install pcnfsd so that rc.local starts the daemon.

To install pcnfsd, follow these steps:

1. From your PC, use nfsconf to mount a directory on a server. For example, mount \\remote\usr\tmp on drive K.
2. Insert the Server 1 diskette into drive A and copy these files to your working directory:

>copy a:r_pcnfsd.c k:	The C source file to compile
>copy a:MAKEFILE k:	Directs the compilation
>copy a:adpcnfsd.csh k:	Automates the installation for inetd

All remaining steps should be performed on the server.

3. Change to the directory on the server into which you placed the files, and become superuser:

```
% cd /usr/tmp
% su
```

4. If you need to make changes to the source, make them now. Only do this if you are an *advanced* system administrator. Possible options include:

SPOOLDIR	The default directory to put the spool files into when rpc.pcnfsd is started.
CHATTY	The daemon prints progress messages on /dev/console; this is similar to running it with the debug option from the command line.
PS630_IS_FIXED	Define as 1 if you are running TranScript 2.0, which has Diablo 630 emulation completely supported. TranScript 1.0 did not allow all font sizes and combinations.

If you are installing `pcnfsd` for `inetd`, continue with these steps:

5i. Run the shell script to make the UNIX binary `rpc.pcnfsd` and edit the `inetd.conf` startup file:

```
# adpcnfsd.csh
```

6i. Reboot your system or manually run `/etc/rpc.pcnfsd`.

If you are installing `pcnfsd` for `rc.local`, continue with these steps:

5r. Rename the C source file:

```
# mv r_pcnfsd.c rpc.pcnfsd.c
```

6r. Run the makefile:

```
# make
```

7r. Copy the binary file to `/etc`:

```
# cp rpc.pcnfsd /etc/rpc.pcnfsd
```

8r. Select a suitable location for the spool directories — for example, `/usr/tmp`. Make sure the file system that contains this directory is exported, without any restrictions, by checking the contents of `/etc/exports`. Then add the following lines to an appropriate place in `/etc/rc.local`:

```
if[ -f /etc/rpc.pcnfsd ]; then
  /etc/rpc.pcnfsd -s /usr/tmp ; echo
  'rpc.pcnfsd'  >/dev/console
fi
```

Note that the line beginning with `/etc` and ending with `/console` is a single line. A good place for this command sequence is immediately after the commands to start up `ypbind`.

With SunOS 4.0, make sure that the spool directory (usually `/usr/spool/pcnfs`) is exported to the PC-NFS clients that will be using it.

9r. Reboot your system or manually run `rpc.pcnfsd -s` *spooldirectory*.

Printer Configurations

Three basic printer configurations can be used with `pcnfsd`: line printer, serial printer, and laserWriter printer. Each of these is described in turn below.

Line Printers. A standard line printer needs no special consideration. Since few PC applications include explicit provision for line printers, you should advise PC-NFS users that only basic ASCII files can be printed, and that they should leave their network printer configured in *Standard Text* mode.

Serial Printers. If you have connected a serial printer to your system, PC applications might be able to make optimal use of it. To do so, they must be able to drive it directly.

Applications that run on UNIX systems rarely include sophisticated printer control. Many system administrators therefore install printer filters to convert selected printer codes into the correct format for their serial printer. Since PC applications, on the other hand, can usually generate the correct codes for the printer directly, you can modify your system to make the most of this. To do so, look at the `/etc/printcap` file on your system. If necessary, create an entry to allow unfiltered access to the printer. It is a good idea to provide an alias for the printer that tells the user what kind of printer it is.

For example, if you have an Epson FX-85™ with serial adapter attached to `/dev/ttyb` as the only printer on server `sunbeam`, the `/etc/printcap` entry might read:

```
lp|epson-fx85:\
    :lp=/dev/ttyb:br#9600:\
    :sd=/usr/spool/lp:lf=/usr/spool/lp/log
```

The PC-NFS user could then add the line:

```
net use lpt1: \\sunbeam\epson-fx85
```

to the `AUTOEXEC.BAT` file and configure the application software as though an Epson FX-85 were directly connected to `lpt1`.

LaserWriter Printers. PC-NFS includes specific support for the Sun LaserWriter or other PostScript printers. For this to operate correctly, you should ensure that the TranScript software that accompanies the Sun LaserWriter printer has been installed according to the manual, and that the support programs are in `/usr/local/bin`. You should use the standard `/etc/printcap` entry.

Before You Port `pcnfsd`

Before porting `pcnfsd` to your environment, read the comments in the source code and consult your Sun Microsystems Customer Support representative to see if such a port has already been carried out. If you do an original port, send details of any adaptations to Sun. These may be folded into the source code and redistributed, which would make it easier for other users to port `pcnfsd` to their servers. If appropriate, Sun will consider posting the sources to "`mod.sources`" on the Usenet.

`pcnfsd` is structured as a simple RPC server daemon, using the highest level of RPC service calls. If the Sun RPC library has been ported to your system, `pcnfsd` might need no more than simple recompiling. If the Remote Procedure Call library is not part of your standard `libc` library, you should modify the `makefile` to search the appropriate libraries.

Certain aspects of `pcnfsd` must not be changed when you port it to a new system. You cannot modify the RPC/XDR structures, for instance, since they are hard-coded into PC-NFS on the client side. You can, however, modify the print spooling strategy (provided that the client interface remains the same). You might, for instance, prefer not to follow the subdirectory-per-client model, which was adopted to compensate for the absence of an *exclusive create* option in the NFS protocol. In practice, a single spool directory arrangement is probably adequate.

If you are running Adobe Systems TranScript software for driving an Apple LaserWriter™, you might need to adapt the specialized "start print" code for Diablo-630 emulation. (If disk space is particularly tight, you can modify this code to use pipes instead of a temporary file.)

Serial Server

This section discusses the use of PC-NFS on a computer which is connected to a remote system or network using an asynchronous serial link, whether hard-wired or dial-up. This technique is generally referred to as "SLIP" — Serial Line Internet Protocol — operation.

Hard-Wired

A hard-wired link is essentially a single RS-232 cable connecting the PC to a server port. It is a relatively permanent, dedicated connection. This configuration treats the link as a "slow Ethernet;" most of the network configuration and management issues are handled as in the Ethernet case. On the server side, the `slattach` program is run during startup which specifies that the port is to be used to communicate with a specific SLIP node at a given speed; the PC does the same with a combination of `CONFIG.SYS` and `net` commands, and communication is established.

In this mode, PC-NFS SLIP is compatible with that distributed as part of the 4.3BSD Berkeley UNIX system. Performance at 9600 baud is generally acceptable, although instead of NFS file access you may wish to use TCP-based services (FTP, RCP, etc.) whose protocols are better-suited to the lower performance link.

Dial-up

Dial-up operation is a very different situation. Not only is a dial-in port a potential security "hole," it is also typically a shared resource, used for interactive UUCP and SLIP traffic in and out. Furthermore, a number of different SLIP clients may be connected at different times through the same or different ports. Therefore, there must be a technique for controlling access and dynamically establishing the network configuration.

The procedure (which is automated using the `connect` program on the PC) allows the user to dial up the gateway system, log in as a normal interactive user, and run the program `/etc/sunslip`. This program validates the request, passes back network configuration information to `connect`, and puts the line into SLIP mode. The PC user can then use PC-NFS network services over the link. When the user has finished, the `hangup` command breaks the connection, causing `sunslip` to reset the line ready for the next dial-in user. Compared with the direct connect case, there are several new configuration and management issues here. There is also a performance degradation when operating at 1200 or 2400 baud. You should use a high-speed error-correcting modem, if possible.

Warning

In many UNIX systems UDP checksum verification is disabled for performance reasons. On an Ethernet, this is not normally a problem. **Attempting to use UDP-based services — including NFS file access — over an error-prone link such as a dial-up line without UDP checksumming is almost certain to lead to data corruption.** Unless you are confident that your link is essentially error-free, you are advised to use only TCP-based services, including TELNET, FTP and PC-NFS LifeLine Mail and Backup. Sun Microsystems cannot be responsible for the consequences if you ignore this warning.

Setting up a SLIP server

The following procedure applies to a Sun-2 or Sun-3 system running SunOS version 3.0 or later.

You will need to have at least one PC connected to your local Ethernet (or a SunIPC with a floppy disk drive). On PC-NFS distribution diskette SERVER 2 you will find a subdirectory `\serial` which contains two files, `makefile` and `slipdist.tar`. Using PC-NFS, copy these files to a suitable directory (e.g. `/usr/local`) on the server. (You must have at least 1MB of free space on this file system.) Log in to the server, use `su` to become superuser, and make the directory to which you copied the files the

active directory. Type **make unpack**; this *uncompresses* the compressed source file and uses the `tar` command to move all of the files into the directory tree `slipdist`.

Installing the Software

The networking subsystem of SunOS is part of the system kernel, so in order to install SLIP it is necessary to build a new kernel. SLIP also uses a number of support programs. To save space, and also to make integration easier for those who have access to SunOS source code, all but two of the components are supplied in source form. The two exceptions (`sys/tty.c` and `net/route.c`) cannot be distributed because of licensing restrictions; the kit includes Sun-2 and Sun-3 binaries for these modules, together with `diff` files which allow source licensees to update the corresponding source files.

To install the software, change to the `slipdist` directory and run the `addslip.csh` script. Read it carefully before running it so that you understand exactly what it will do to your system. If you have already customized your kernel using, for example, the configuration file `YOUR_CONFIG`, you type:

```
% addslip.csh YOUR_CONFIG
```

which builds a new kernel in the directory `YOUR_CONFIG-SL`. It also installs the `sunslip`, `mkslipuser`, `dslipuser` and `slattach` programs in `/etc`. The correct permissions for these files are:

```
sunslip      rwxr-xr-x   owner root
mkslipuser   rwxr-xr-x   owner root
dslipuser    rwxr-xr-x   owner root
slattach     rwxr-xr-x   owner root
```

To complete the software installation, you copy the new `vmunix` into the root and install it as usual. For instance, type:

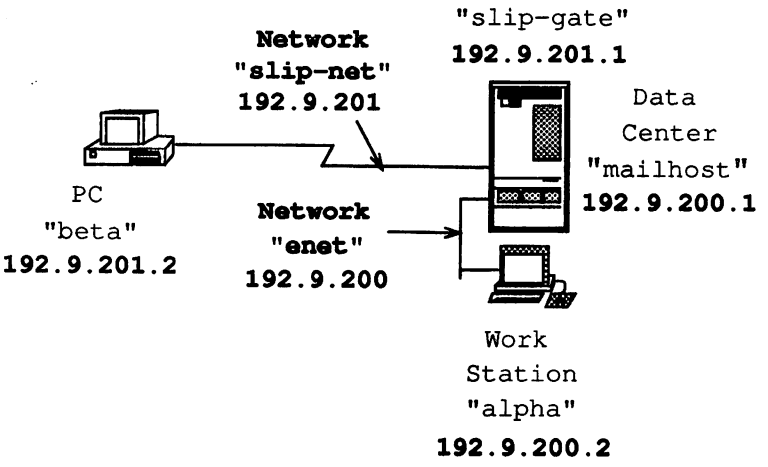
```
% cd /usr/sys/YOUR_CONFIG-SL
% cp vmunix /vmunix.slip
% cd /
% mv vmunix vmunix.old
% ln vmunix.slip vmunix
% /etc/fastboot
```

If you have not already done so, you should make sure that the server is running the `pcnfsd` (or `rpc.pcnfsd`) daemon (See the section *Installing pcnfsd – The Procedure* for details). If you run Yellow Pages, you should configure the server as a Yellow Pages server, as described in the SunOS docubox under *ypinit(8)*.

Network Configuration

The next step is to set up the various network data bases to describe the new SLIP network and the hosts that will be connected to it. Whether hard-wired or dial-up, this part of the configuration is very similar to that described in the SunOS System Administration documentation. As Figure 4-1 shows, you assign a name and (net or subnet) address to the SLIP side of the gateway and to each PC which can be connected.

Figure 2-1 *Names and Addresses*



Direct Connections. For each SLIP client with a hard-wired connection, make sure you disable logins on the corresponding TTY line (i.e. the corresponding line in `/etc/ttys` should begin with a "0") and verify the baud rate for the tty line. Then add a line of the following form to `/etc/rc.local`, **before** the command to start *routed*:

```
/etc/slattach /dev/ttynn gateway-name client-name speed & \
  > /dev/console
```

For example, if PC `beta` is attached to `/dev/tty04` on server `mailhost` (known as `slip-gate` on the serial network) at 9600 baud, the line would be:

```
/etc/slattach /dev/tty04 slip-gate beta 9600 & \
  > /dev/console
```

Dial-up Connections. In hardwired connections, the `slattach` command binds a network connection to a particular serial port. For dialup connections you need to identify network connections by user name, so that when a user logs in and requests SLIP operation you can validate the request and assign the correct names. You need to keep track of which SLIP connections are active, and also need to control the number of simultaneous SLIP sessions. These are accomplished as follows:

Add the following lines to `/etc/rc.local` immediately before the line "`/etc/mount`":

```
if [-f /etc/slip.config -a -f /etc/mkslipuser]; then
    echo 'resetting SLIP user table' >/dev/console
    /etc/mkslipuser
fi
```

Decide how many simultaneous SLIP sessions you wish to support. This number should be less than 8 (the number configured into the SLIP driver), and no more than the number of dial-in ports on the system. Now use a text editor to create the file `/etc/slip.config`. For each simultaneous SLIP session, add a line consisting simply of the name of the gateway. In the example in the diagram, if you want to allow up to four simultaneous SLIP sessions you would edit `/etc/slip.config` to read:

```
slip-gate
slip-gate
slip-gate
slip-gate
```

Next identify the dial-in users who are to be permitted to run SLIP. For each one, assign a host name on the SLIP network. If you have a large dial-in user population and limited network addresses, you may choose to share a single address among several users. If you do so, you should be aware that only one user can use an address at a time, and the users should not use services which might attempt to connect to the PC from elsewhere in the network (e.g. SMTP mail). Having established the set of legal users and the corresponding host names, edit the file `/etc/slip.hosts` to reflect this. Each line in this file consists of a host name and the corresponding user name. For example:

```
beta user1
gamma user2
delta user3
delta user4
```

Note that in this example `user3` and `user4` share the host name `delta`, so that only one of them can run SLIP at a time.

At this point you can either reboot your system or run the program `/etc/mkslipuser`, which will set up the file `/etc/slip.user`. This file records the state of all dial-up SLIP sessions; you can use the program `/etc/dslipuser` to display this record.

Troubleshooting

You can verify that the SLIP kernel has been installed correctly by running `slattach` on an empty line, using *ping(8)* to send packets to the phantom host on the line, and then using the "`-i`" option to *netstat(8)* to verify that the interface "`sl0`" is configured and has transmitted packets. (Don't forget to kill the `slattach` process afterwards.)

Installing Locking Services Server Software

This section is for the system administrator who wants to install PC-NFS Locking Services on an NFS server.

NFS server Locking Services consists of three programs:

1. The Locking Services "Kernel Lock Manager" intercepts local locking system calls and routes them to the "Network Lock Manager program."
2. The "Network Lock Manager program" (`rpc.lockd`) communicates with other lock manager programs on the network to maintain a globally consistent locking state, and relies upon the "Status Monitor program." Note that you must be running Version 3 or later to use PC-NFS locking services.
3. The "Status Monitor program" (`rpc.statd`) monitors the state of systems in the network and notifies its clients when a system goes down and comes back up.

If your Sun NFS server supports locking services, these three programs already exist on your Sun network. However, to support PC-NFS locking services you need to replace `rcp.lockd` and `rcp.statd` with the copies on the PC-NFS installation diskettes.

If your NFS server is not a Sun, Sun has distributed version 3 `rcp.lockd` and `rcp.statd` to NFS licensees. If they are not on your system contact your NFS vendor.

The procedure for installing the PC-NFS Locking Services server software depends on which release of SunOS you are running. The following sections describe these procedures.

SunOS Before 3.2

Locking Services are not correctly supported on SunOS versions prior to SunOS 3.2. If you need this support, you should upgrade your server to SunOS 3.2 or higher.

SunOS 3.x

Servers running SunOS 3.2 normally run both the lock manager and status monitor programs. To support PC-NFS you must install a new version of the lock manager. You can find a binary version of this program on your PC-NFS distribution diskettes. If you are installing to a Sun3 server, copy the file `r_lockd`. For a Sun4 server, copy the file `r_lockd.s4`. The following procedure uses the `r_lockd` file, but the procedure is the same for both.

1. Using PC-NFS, copy the file `r_lockd` to the NFS server.

   For example, you mount file system `\\server_4\usr\tmp` on network drive `Q` and then copy the file there. From the PC, type:

   ```
   C>net use q: \\server_4\usr\tmp
   C>copy a:r_lockd q:
   ```

2. Log in as superuser on the NFS server, terminate the old lock manager program and install the new one:

   ```
   # ps ax | fgrep rpc.lockd
   # kill -9 rpc.lockd's-pid
   # mv /etc/rpc.lockd /etc/rpc.lockd.dist
   # mv /usr/tmp/r_lockd /etc/rpc.lockd
   # chmod 0755 /etc/rpc.lockd
   ```

3. Start up the new `rpc.lockd` daemon and verify that it is running by typing:

   ```
   # /etc/rpc.lockd
   # rpcinfo -u localhost 100021
   ```

This should indicate the program is ready and waiting.If you want to monitor file sharing violations and help PC-NFS users with troubleshooting, execute `rpc.lockd` with the option `-sl`. This generates a log of all file sharing violations that appears on the system console.

SunOS 4.0 and Higher

Sun386i's with SunOS 4.0.1 correctly support Locking Services. If you are running a SunOS less than 4.0.1 you should upgrade.

For Sun-3 and -4 systems running Sun OS4.0 or higher you must install a new version of the lock manager. You can find a binary version of this program on your PC-NFS distribution diskettes.

If you are installing to a Sun3 server, copy the file `r_lockd`. For a Sun4 server, copy the file `r_lockd.s4`. The following procedure uses the `r_lockd` file, but the procedure is the same for both.

1. Using PC-NFS, copy the file `r_lockd` to the NFS server.

   For example, you might mount file system `\\server_4\usr\tmp` on network drive `Q` and then copy the file there. From the PC, type:

   ```
   C>net use q: \\server_4\usr\tmp
   C>copy a:r_lockd q:
   ```

2. Log in as superuser on the NFS server, terminate the old lock manager program and install the new one:

   ```
   # ps ax | fgrep rpc.lockd
   # kill -9 rpc.lockd's-pid
   # mv /usr/etc/rpc.lockd /usr/etc/rpc.lockd.dist
   # mv /usr/tmp/r_lockd /usr/etc/rpc.lockd
   # chmod 0755 /etc/rpc.lockd
   ```

3. Start up the new `rpc.lockd` daemon and verify that it is running by typing:

   ```
   # /usr/etc/rpc.lockd
   # rpcinfo -u localhost 100021
   ```

This should indicate the program is ready and waiting.If you want to monitor file sharing violations and help PC-NFS users with troubleshooting, execute `rpc.lockd` with the option `-sl`. This generates a log of all file sharing violations that appears on the system console.

Adding PC-NFS to your Sun Network

If you are adding PC-NFS to a Sun Network, use the following checklist to ensure you have made the appropriate changes to support PC-NFS.

1. You must add the PC host name to the `/etc/hosts` file of any host system you want to access from PC-NFS. If you have Yellow Pages, you need only add the PC host name to the `/etc/hosts` file on the Yellow Pages server.
2. If the PC-NFS user is new to the network, add the user name to the `/etc/passwd` file of any host system you want to access from PC-NFS. If you have Yellow Pages, you only need to add the user name to the `/etc/passwd` file on the Yellow Pages server.
3. If the PC-NFS user is new to the network, you must create a home directory and set up a `.login` file.

4. If you have RARP, you must add the PC Ethernet address to the `/etc/ethers` file any host system you want to access from PC-NFS. If you have Yellow Pages, you need only add the Ethernet address to the `/etc/ethers` file on the Yellow Pages server.
5. If you have Yellow Pages, be sure to `make` and `push` the Yellow Pages so that all of your data base changes are distributed.
6. If `pcnfsd` is not on all Yellow Page master and slave servers, then you must have each PC user specify the `pcnfsd` server using the `nfsconf` program.
7. You must have a `/etc/exports` file on the NFS server running `pcnfsd`. If your `/etc/exports` file explicitly lists hosts that may access particular file system, add the PC host name to any file system you want to export to the PC.
8. Any file system you want to mount must be in `/etc/export`. It must also have the correct permissions set.
9. If you are adding a PC to a stand-alone Sun server to create a network, make sure that you start the network on the Sun server. See the `ifconfig` command in the Administration section of the Sun Commands Reference for information about starting your network. Put the `ifconfig` command in your `rc.boot` file.

Troubleshooting PC-NFS

5

When you encounter problems while running PC-NFS, you can try to solve them at two different levels:

- At the DOS level, where, as the user, you investigate the problem on the PC running PC-NFS, and
- At the network server level, which may require action by the network manager.

With the help of the information in this chapter, you should be able to resolve most of your problems. If you have further questions and if you have a software contract for PC-NFS, you can call the "800" number supplied with your contract.

This chapter is broadly divided into two areas: things to check if you have problems while setting up PC-NFS on your PC (installation, configuration, and network), and things to check if you have problems while running applications, using files or printing.

PC-NFS Installation and Configuration

Check the DOS Version

Make sure your system is using DOS Version 3.0 or higher and that the server you are trying to use is capable of supporting PC-NFS. To find out which version of DOS you have, use the DOS VER command.

Check That You Have Enough Memory

Make sure there is enough memory and enough disk space for your application to execute properly. When PC-NFS is running in a system, approximately 85K of memory is used by PC-NFS and the network drivers (`PCNFS.SYS`, *<board_type>*`.SYS` and `PRT.EXE`). The 3C505 board may increase this total. When the `telnet` program is used with PC-NFS, an additional 130K of memory is used.

Check the PC-NFS Installation

Make sure that you have installed the PC-NFS software correctly. Refer to Chapter 1 to make sure you have followed all the required steps. If necessary, you can re-install PC-NFS as described below in *"Re-installing PC-NFS."*

In general you do not have to re-install. You can use the `nfsconf` program to correct errors such as choosing the wrong connection board or choosing the wrong parameters for your board.

PC-NFS `install` Program and SunIPCs. The PC-NFS `install` program may ask you if you are using a SunIPC. A SunIPC is an *Integrated* PC, i.e. a PC running on a Sun workstation. This question occurs occasionally if your machine is a non-standard IBM clone. If you are not installing onto a SunIPC, answer "No" to this question and continue with the rest of the installation.

PC-NFS `install` assumes that drives `A` and `B` are diskette drives. All other drives are presumed to be hard drives.

Upgrading PC-NFS. If you already have PC-NFS installed and you bought a new copy of PC-NFS that was not an update copy, that is, you bought a copy with a new serial number, PC-NFS asks you if you want to do an upgrade. If you want to continue to use your old serial number, answer "Yes." If you want to use the new serial number, answer "No."

Check the Configuration and Connections

Make sure your PC is correctly configured and all network cables are intact. The following procedure ensures that the communications controller is functioning correctly in your PC:

- Use the `netstat -i` command to see if your PC is able to receive Ethernet packets. If the number of received packets is "0," the network manager may need to take action, as described later in this chapter.

- Verify that the communications board is functioning properly by using the diagnostic program supplied by Sun or the board manufacturer. Be sure to disable PC-NFS before using a controller diagnostic program, as the two programs would conflict and produce unpredictable results if run together. Follow the instructions given in the section, "Disabling PC-NFS."
- Make sure that your communications controller is correctly configured. In most cases your controller will have all jumpers set for its default configuration (except for the Leading Edge Model D, or if you've configured to use a different interrupt number). Refer to the installation manual for the controller you are using for more information.

  If your PC is a Leading Edge Model D and you are using one of the 3Com 3C501, 3C503, 3C505, or Micom-Interlan NI5010 controller cards, the I/O base memory address jumpers and the I/O port address (use `nfsconf`) must be set to a value other than "300." A good alternative value is "330." Check the manuals of the other hardware cards you may have added to your PC to ensure that no other hardware has the same address as your communications controller.

Try Disabling PC-NFS

Try running your application without PC-NFS in the system to verify that the application runs properly on a non-networked DOS. To do this, rename the `CONFIG.SYS` and `AUTOEXEC.BAT` files in your root directory to some other name (such as `CONFIG.NFS` and `AUTOEXEC.NFS`) and reboot the system. By renaming these files and rebooting the system, you have disabled the automatic loading of the PC-NFS drivers into the system. See the section, "Disabling PC-NFS," below.

If after removing PC-NFS from the system the application still experiences problems, then the problem is probably not caused by PC-NFS. Consult the documentation for the application that is causing the problem. To re-enable PC-NFS, change the `AUTOEXEC.BAT` and `CONFIG.SYS` file names back to their original form. See the section, "Re-installing PC-NFS" below.

Disabling PC-NFS. If you want to uninstall PC-NFS, you can use the following sequence. Change directory to the root of the disk from which you boot and type:

```
C>DIR *.OLD
   (verify that AUTOEXEC.OLD and CONFIG.OLD exist)
C>RENAME AUTOEXEC.BAT AUTOEXEC.NFS
C>RENAME CONFIG.SYS CONFIG.NFS
C>COPY AUTOEXEC.OLD AUTOEXEC.BAT
C>COPY CONFIG.OLD CONFIG.SYS
C>REBOOT
```

If you have upgraded or installed the software more than once, delete lines containing any of the following from `AUTOEXEC.OLD`:

- `net` <command>
- `NFSRUN`
- `PRT *`

Delete lines containing any of the following from `CONFIG.OLD`:

- `PCNFS.SYS`
- `SOCKDRV.SYS`
- (board_type)`.SYS`

Re-installing PC-NFS . The installation program allows you to re-install even though PC-NFS has been installed before. It assumes that the DOS system file `ANSI.SYS` is in the root or wherever it is specified in `CONFIG.SYS`.

If you run the PC-NFS `install` program on a PC that already has PC-NFS installed, the configuration does not necessarily change. All the PC-NFS files are copied over, although all your configuration files are saved. Unless you specifically ask it not to, you get a new serial number. You might do this, for instance, if you moved your PC from one network to another.

PC-NFS License Violation Detection

A PC-NFS license violation occurs when multiple copies of a single licensed copy of PC-NFS software are present on a network. Under PC-NFS licensing restrictions, each copy of PC-NFS is for a single user only. It is not to be shared. PC-NFS does not use a copy protection scheme. This means that you

can freely make copies of PC-NFS, including backup copies and diskette and hard disk installations. Again, the copies themselves are not illegal, but their simultaneous use *is* illegal.

Duplicate Copies Disrupt Everybody's Work. Although you can make copies of PC-NFS, the software notifies you if anybody uses a copy improperly. Here's what happens:

Each copy of PC-NFS includes a unique serial number. When the network detects a duplicate copy of PC-NFS, the screen of every user who shares that serial number displays a warning similar to the following:

```
******* PC-NFS License Violation Detection **************

The serial number of this copy of PC-NFS is PC-NFSxxxxxxxx

Another copy with this serial number is in use on the network.
It is being used on a system with Ethernet address
02:60:7b:13:49:60 and Internet address 191.6.22.128.

Under the terms of your license, Sun Microsystems Inc.
authorizes you to make archival copies of this software
provided that there is NO POSSIBILITY of it being used at
one location while it is in use at another.  Multiple use
of a single serialized copy constitutes a violation of this
license and of Sun Microsystems Copyright.

Your system (including PC-NFS) is fully operational, but the
video has been reset to 80x25 text mode.  Depress the
ALT key to continue.
```

The preceding display interrupts any work in progress on the screens of *all* of the users involved. If anybody is running an application in graphics mode (for example, Microsoft® Windows), some work may be lost, and it might not be possible to recover all application data.

If a user continues to use a duplicate copy of PC-NFS, the network repeats this license violation 3 times. After the third time, all PC-NFS network activity is disabled.

Tampered PC-NFS Serial Numbers Stop PC-NFS. If a user tampers with the serial number on a copy of PC-NFS, the result is:

1. An illegal serial number, or
2. A duplicate of an existing serial number.

In the second case, the warning described in the preceding section appears on the screen of the users with the duplicate serial numbers.

An illegal serial number is a serial number that was not assigned by Sun Microsystems. If PC-NFS detects an illegal serial number, the screen of the user in question displays the following fatal error message:

```
The serial number of this copy of PC-NFS has been tampered with.
This constitutes a violation of the terms of your license
agreement with Sun Microsystems Inc.  PC-NFS has been disabled.
Your system is fully operational apart from this.
Depress the ALT key to continue.
```

Troubleshooting Network Problems

On occasion PC-NFS users might attribute difficulties with PC-NFS operations to network or server problems. As a server manager, you should be aware of the diagnostic tools available on the client and server sides and of the ways in which PC-NFS can interact with the network. Throughout this section, the tools described are tools running on Sun servers. If your server is not a Sun, your server system may have equivalent tools.

In general, the first step in solving a network problem is to isolate the problem.

- Is it an Ethernet cable problem, a communications controller problem on the PC, or a problem with the server?
- Is one side transmitting and the other not receiving or is the "transmitter" not really transmitting?

The utilities `netstat` and `nfsping` (on the PC) and `netstat`, `ping` and `etherfind` (on the server) can help you to answer these questions. You may also want to run the commands in `\NFS\NETWORK.BAT` by hand to see where the first error occurs.

Verify That the Network Is Active

Make sure that the network is enabled on the server system that you are trying to access. If other users are employing PC-NFS to access the same server, then the network is obviously working. A quick check to verify that the network is enabled on your server system is to try to `ping` another host on the network. From the server in question, type:

```
% ping hostname
```

Where *hostname* is another host on the network. If you get the message:

```
Network down
```

then possibly the network is disabled for that system. Refer to the manual *Networking on the Sun Workstation* to verify proper network operation.

Check Network Connectivity

Duplicate Internet addresses confuse network software. The PC-NFS software can detect duplicate Internet addresses only on other PCs running PC-NFS on the network. Use the `arp` command to inspect Internet addresses. If you detect a duplicate, inform your network manager.

PC-NFS does not include the UNIX `ping` utility. The `nfsping` utility is analogous, but works at a higher level: it verifies that PC-NFS can talk via RPC to the `mountd` daemon on the server. PC-NFS does, however, respond to ICMP echo requests. You can therefore use `ping(8)` from a SunOS server to verify network connectivity. If the PC does not respond to the `ping`, run the `netstat` utility on the PC while using the `ping` command. This displays the count of ICMP requests received by the PC.

If the count does not increment, the PC physical connection may be faulty or the network may have failed. If the ICMP message count *does* increment, you may want to use `etherfind(8)` or `traffic(8)` on a different SunOS server to see if the ICMP responses are getting out to the network or if the transmit side of the PC network interface has failed.

Trailer-Encapsulated Packets Not Supported

PC-NFS does *not* support the use of 4.2BSD "trailer-encapsulated" Ethernet packets. If PC-NFS appears to work except for operations that read large chunks of data (such as file transfer with `ftp` or `rcp`), you should run the `ifconfig(8)` program on the server to determine whether trailers are turned on. You can disable the use of trailers by adding the option `-trailers` to the `ifconfig` commands.

Routing Through Gateways

PC-NFS incorporates a very simple routing strategy. All Internet datagrams targeted at networks other than the local net are forwarded to the gateway system selected by the `net route` command at `PC-NFS` startup. If no gateway has been designated, the datagram is not sent. The number of datagram transmissions that fail in this way is displayed by the `netstat` command. If a server is moved from the local network to a network that must be reached in one or more hops, you must ensure that a gateway PC is known to PC-NFS. This happens automatically if Yellow Pages are used. If you are not using Yellow Pages, you can specify a gateway machine using the advanced questions screen of the `Network Direct` configuration screen of the `nfsconf` screen. A gateway is not needed for dial-up serial operation.

Limitations on Gateways

PC-NFS cannot handle multiple gateways, and does not respond to ICMP "Network Unreachable" or similar control messages.

General PC Application Problems

This section deals with problems which may affect application programs generally. Sun has tested many of the popular PC applications and utilities with PC-NFS. Many special considerations, restrictions, or incompatibilities are noted in Chapter 6, "Application Notes."

PC Application Performance

Now that your PC is part of a network, you have convenient access to remote files and peripherals. However, you no longer have *exclusive* access to the resources that your PC applications use. For example, one of your PC applications might use a database that resides on the disk of an NFS server. This database might also serve PC applications that belong to other network users.

Under PC-NFS, PC application performance can vary for the following reasons:

- Another user or system program might be using a network resource that your PC application needs. This is called *resource contention.*
- It might take the network some time to respond to your PC application's request for services. This is called *network latency.*

Except under unusual conditions, PC application performance differences under PC-NFS should be minimal. If you experience a more serious deterioration in PC application performance, the network manager may be able to make adjustments on the network that improve your PC application's access to necessary resources.

Check For Special Requirements

Verify that your application is not performing operations that would interfere with PC-NFS operation. A few of these operations are listed below.

1. The application disables interrupts for an extended period of time. If `telnet` is running in the background, it needs to perform various interrupt- and clock-driven functions to keep your session alive.
2. The application is "stealing" the Real Time Clock interrupt and not passing the interrupt along.

3. The application goes completely around DOS for all I/O operations. One such program is Microsoft's Flight Simulator®, which, when running, does not use DOS at all.
4. The program is bypassing the DOS file system and performing "raw" disk I/O operations. For example, the Norton Utilities™ does not work on a remote PC-NFS drive because this software accesses the drive at the track/sector level instead of using DOS. Programs that try to access the controller directly for a networked drive fails.

Check For Copy Protection Violation

Check whether the application program uses a copy protection scheme that does not work with a network disk. You can execute some programs from a network disk, but the software does not allow you to "move" the copy protection to the remote disk. Many copy protection schemes are designed to prevent their use from a network disk.

Please consult the manual and license of the application you are trying to use. Many PC software companies are now offering site licenses to large volume customers; site licenses allow remote access and use of PC applications without copy protection.

Serial Problems - SLIP

Serial direct connections via SLIP are really *subnet* connections. This may cause some confusion. The server you are connecting to must have two names and two IP addresses. The serial connection to the server is considered a separate network, and thus the server becomes a *gateway* between two networks, the serial one and the network you are trying to access. This server should be a Yellow Pages server and have `pcnfsd` running. If `pcnfsd` is not running, issue a `net route` command to establish routing.

For dial-up serial connections, the server should be a Yellow Pages server and be running `pcnfsd`. Also you must have a log in name on the system you access; you cannot gain access as user `nobody`.

Check Your Memory Resident Programs

If you use multiple "Terminate and Stay Resident" programs, such as Sidekick™ or Keyworks™, take careful note of the order in which you load the programs. If you experience problems with the keyboard or disk access, try running your system without these programs in memory; then load the programs one by one until you find the program that is causing the problem.

Files in a Networked Environment

Differences Between DOS and PC-NFS

For the most part, you can work with NFS file systems just as you work with your PC's local files. However, there are some ways in which PC-NFS affects the way DOS functions. This section describes these differences.

Check Your Use of Backslashes and Slashes. Pay careful attention to the use of backslashes (\) and slashes (/), which are used differently in DOS and SunOS. Using "/" instead of "\" can cause errors that are hard to diagnose. For example, the PC-NFS command

```
C>net use LPT1: //mainsys/LPT1:
```

would produce the message

```
NFS033F:  Unable to contact PCNFSD daemon on
server (or syntax error).
```

Replacing each "/" with the correct "\" gives the desired results.

Appending. You can use >> (append) to append output to a directory or file. However, under PC-NFS, you cannot append a file to itself on a mounted file system; doing so creates an infinite loop.

DOS Commands and Utilities That Don't Work on NFS Files. Most DOS commands and utilities work normally on NFS files. However some DOS commands and utilities *don't* work on NFS files or any remote file system. These commands are listed below. Remember that these commands and utilities work normally on files that reside on your PC's diskettes and hard disk. For example, you won't encounter any problems if you use the LABEL command to create a volume label for a diskette on drive A. However, you cannot use the LABEL command to change an NFS disk label.

DOS commands that *do not work* on NFS files:

CHKDSK	Analyzes the directory use and storage capacity of a disk.
DISKCOMP	Compares one disk to another.
DISKCOPY	Copies one disk to another.
FDISK	Creates, changes, deletes, or displays partitions on a hard disk.
FORMAT	Prepares a disk for use.

`JOIN`	Connects a disk drive to a directory on a different drive. This is similar to the SunOS `mount` command. Use `net join` instead.
`LABEL`	Creates, changes, or deletes a volume label on a disk.
`RECOVER`	Recovers files from a disk that has defective sectors.
`SUBST`	DOS 3.1 SUBST causes a drive specification to refer to another drive. `SUBST` in DOS 3.2 works.
`SYS`	Transfers operating system files from one disk drive to another.

The commands and utilities listed above work only on local files and drives. When you work with files on a mounted file system, however, you are using a remote disk. The fact that you are using a remote disk is usually not apparent. However, you need to keep the distinction between physical and logical disks in mind when you attempt to:

- Physically alter the format or content of a diskette or hard disk, or
- Use DOS commands that duplicate PC-NFS services.

Note that you *can* store and run these programs on a remote NFS disk, but they can only operate on local DOS disks.

Check for Name Mapping Problems

If you suspect that the trouble is with file names that are translated by PC-NFS, refer to the discussion of file name mapping in the *PC-NFS User's Manual*. Use the `ls` command to inspect the file names, and `mv` command to change file names that may be a source of trouble.

Illegal Names That Pass PC-NFS. PC-NFS allows you to create certain DOS-illegal names without error, provided that the application does not check the name syntax. However, if the name is ever displayed as part of a directory listing, PC-NFS maps it as usual.

Avoid Using Mapped Names. The mapped file names that PC-NFS creates are temporary *handles* used only by PC-NFS. Name mapping does not necessarily produce the same result each time. Therefore, you should not build mapped names into your applications. At any point in time, PC-NFS commands can show you which mapping is in effect.

The "Name Cache." PC-NFS only keeps track of the mappings of the last 64 names it has processed. It does this by placing the mappings in the *name cache*. This can affect programs that read directory structures and retain the names for later use. For example, some file and disk maintenance programs might display a mapped file name on a networked file structure, and then not allow you to access the file. This happens because 64 new mappings were created by PC-NFS after the name you want was placed in the name cache. Xtree™ by Executive Systems Inc. and GEM Desktop™ by Digital Research are two such programs.

If you suspect that name mapping is causing a problem, rename the files to fit the DOS limitation of eight character names and three character extensions. Use the `mv` command to rename the file as described in the Command Reference chapter in the *PC-NFS User's Manual*. Then retry the application. Also keep in mind that PC-NFS only processes names that are fewer than 64 characters in length. If you have a file with a name more than 64 characters in length, rename the file.

Converting Files – `dos2unix` and `unix2dos`. If you are transferring files between your PC and a server, you may find that some files display differently than they print, or display differently when stored on different file systems. This problem most often occurs with files created with a DOS program, and sent to a server via `telnet` to be printed. For example, programs like Wordstar™ set the most significant bit of some characters. This does not affect the way they look on the screen as displayed by `telnet`, but does affect some printers.

This type of problem can usually be fixed by using the `dos2unix` and `unix2dos` programs. These two utilities are described in the *PC-NFS User's Manual*.

Invisible Files. If you use `chmod` to deny yourself both read and execute permissions, you are no longer able to access the file from DOS (or even see it in directory listings). However, you can still log in to your server system (with `telnet`) and change the file permission to make the file readable.

Superuser for Fixing Problems. On most NFS server systems there is a special user named "root" or "superuser." This superuser can change any user's file attributes. If you have problems with file attributes, such as permissions or groups, as system administrator you may be able to solve the problems while logged in as superuser.

Permissions: Special Considerations

Many DOS commands and utilities expect to encounter files for which read access is permitted. If read access is *not* permitted, the resulting error message may be confusing or misleading. For example, if a program attempts to open an unreadable file, the message "`file not found`" may be displayed, even though the file does exist. Another possibly confusing error message that can occur if you attempt to create a file within an improperly protected directory is "`file creation error.`"

File Locking Problems

Each section below details a different problem with file locking.

Check For Simultaneous File Access

If the program you are trying to use is having problems with data files on the server, make sure that no one else is trying to access the same file at the same time. If file locking is not in operation, two programs on different PCs could possibly access and change the same file at the same time. A file can become corrupted if two systems or programs write to a file at the same time.

Using `/MUSTSHARE` prevents all access to the drive if the File Locking Services detect a Lock Manager failure.

If Your Server Crashes

PC-NFS File Locking Services cannot detect server crashes and do not recover file locks when a server comes back up. Instead, the File Locking Services attempt to handle server crashes in a manner consistent with DOS 3.1 semantics. Generally, when a server crashes, the network reports an error to the PC application when it makes its next network request.

If Your PC Crashes

If your PC crashes while you have files open on a network drive that enforces locking, your file sharing and byte-range locks remain active. After a PC crash you must boot your PC and re-mount any network drives. When you do this, the Lock Manager program clears out any old locks.

Network Applications - rsh and telnet

Each section below details a different problem with either rsh or telnet.

telnet Problems

If you are using your application while telnet is active in the background, try using it without telnet resident. telnet does require memory from your PC and does require the use of the PC's real time clock even when it is in the background. This might interfere with your application.

Caution on Background telnet. When you use telnet to establish a connection to a server over the Ethernet, the server periodically sends messages to the client to make sure that the client is still alive. These messages are referred to as *keepalive* messages. They must be answered by the client even when telnet is in the background. If you are running an application that does not allow interrupts, telnet is not able to answer the keepalive messages. If this continues for about 2 minutes, the network breaks the telnet connection. Therefore, you should save as much of your work as possible before putting telnet in the background. Note that telnet cannot respond to keepalive messages when the message:

```
Abort, Retry, or Ignore?
```

appears on your screen and the system waits for a user response. Similarly, telnet cannot respond to keepalive messages when a license violation has been detected and the system waits for the user to depress the Alt key to continue.

Caution on Background telnet after Escape. Do not place telnet in the background after you have started it by escaping to COMMAND.COM from another application (such as Lotus 1-2-3®). If you place telnet in the background this way, the system will crash.

Graphics Modes and telnet. If you use the Hot key feature to activate a resident telnet session while executing a DOS application in graphics mode, the application screen image is lost. When telnet returns control to the application, the screen is blank, but in the correct mode. telnet was designed to save only the character screen. The size of the buffer needed to save a graphics screen image is prohibitive for a program that loads and stays resident. Consult the documentation for your application to determine the correct way of redrawing the graphics screen image.

Windows and Resident `telnet`. You cannot use a resident `telnet` from within Microsoft Windows. While running Windows, you cannot invoke the resident `telnet` session with a Hot key.

You can, however, run `telnet` as an application within Windows, if you set up a Program Information File (PIF) for `telnet` correctly. Chapter 6 contains more detailed information about using `telnet` and Windows at the same time.

`telnet` on the PS/2 (VGA). If you are running on a system with a VGA display adapter, such as the IBM PS/2™ computer line, highlighting within `telnet` displays underlining if, when `telnet` is started, the screen mode is 7 (monochrome display compatible). You can obtain highlighting if you change mode at the DOS prompt with the command:

```
C>MODE CO80
```

and then reenter `telnet`.

Hot key Delay. When you enter the `telnet` Hot key sequence, `telnet` may not pop up right away. This occurs when the current application is waiting in a DOS system call. When the system call is complete, `telnet` pops up.

Troubleshooting Printers and Printing

Files Do Not Print

If you try to print a file, but nothing comes out on the printer, you can take one of several steps to isolate the problem.

1. Printing may not have been initiated. For example, if you type:

```
C>COPY MYFILE LPT1:
```

this is handled directly by the DOS command processor; no program exit occurs. Alternatively, the printer may be configured for manual print initiation. Either way, typing:

```
C>net print * LPT1:
```

forces anything "in the pipeline" to be printed.

2. The printer redirection may not be what you expect. Type:

```
C>net use
```

which displays printer redirections as well as mounted NFS disks.

Use the configuration program to check that the proper DOS printer is redirected to the proper server printer and that the correct printer mode is being used. Also check the server to verify that the printer on that side is the expected printer. Review the Printing Chapter of the *PC-NFS User's Manual* if you are not sure.

3. Make sure the printer is on-line and does not require paper or ribbons. Also check that you are using that particular printer properly.
4. The `pcnfsd` daemon may have failed in some way. To check this, you can look at the spool file. The spool directory for the device `LPT1` is mounted as NFS device `T`, that for `LPT2` as `U` and `LPT3` as `V`. Type:

```
C>DIR T:
```

to examine the spool directory for `LPT1`. Don't worry if you see a number of old, zero-length files; these can (in general) be deleted. If you see a file with non-zero length and a creation date and time corresponding to when you started the printing, that's probably your spool file. If it has a name ending in `.spl`, it shows that `pcnfsd` has received the request to print the file, has successfully renamed the file, and has tried to submit it to the print subsystem on the server. If the file name has no `.spl` extension, `pcnfsd` didn't receive or process the request — it may have failed in some way that PC-NFS can't recognize. Check that its existence using `rpcinfo -u localhost`. It should reply: `ready and waiting`. The network manager should probably check out the `pcnfsd` daemon on the server. In any case, you can try to print the data by using `net print` on the spool file itself.

5. If `pcnfsd` has created the `.spl` file, or if there is no spool file visible in the directory, the problem probably lies in the print spooling subsystem on the server. On a Sun server, for example, you can use the commands `lpq` or `lpc status` to see if your job is stuck in the print queue for some reason. Check the documentation for the server operating system.

Files Not Printing Correctly

If your files do not seem to be printing properly try one of the following remedies:

1. If files created with a DOS program display, but do not print correctly when using `telnet`, use the `dos2unix` program to translate the files to UNIX format before printing. Programs like Wordstar set the most significant bit of some characters. This does not affect the way they look on the screen as displayed by `telnet`, but does affect some printers.
2. If text runs off the top or bottom of the page, try using a *form feed* between pages instead of spacing with *line feeds*.
3. For some applications you may need to split the file into two or more parts before printing it.

See the chapter "Using Printers" of the *PC-NFS User's Manual* for further information on printer use.

Printer's Output Already Redirected

In some cases, PC applications are tied to a particular printer (typically `LPT1`.) Since the `net use` command requires that the output for *printdevice* is not already redirected, you might sometimes need to cancel a previous redirection.

There are two ways to accomplish this. The first is to use the `Resources` menu item of the `nfsconf` program. See Chapter 2 of this book for details.

You can also use the following command line to cancel the redirection of a printer's output:

```
C>net use printdevice: /d
```

If *printdevice* is not currently redirected, PC-NFS displays an NFS system message and ignores the request.

Read the rest of this section only if:

1. You have access to an NFS print server with an attached Sun LaserWriter, or
2. You need to change the default print initiation mode.

LaserWriter Problems

LaserWriter as a PostScript Printer. If you have a PC application that can generate PostScript commands, you can use a remote LaserWriter printer.

You should be aware, however, that some applications (for example, early versions of Digital Research's GEM) omit important PostScript control information. To compensate for these omissions, select PostScript mode when you configure your printer.

LaserWriter as Diablo-630. **Note:** Due to a problem with the `ps630` utility in release 1.0 of the TranScript software, the `pcnfsd` daemon software is shipped with the font and pitch selection features disabled. You have the problem if the message "`NN is not a valid pitch, 10 will be used`" (where `NN` is pitch setting) appears at the `pcnfsd` daemon console. Sometimes this error hangs `pcnfsd`.

The `ps630` problem is resolved in release 2.0 of TranScript. If you have release 2.0 of TranScript installed at your site, you should ask your system administrator to rebuild `pcnfsd` from the source file supplied with PC-NFS, using a command of the following form:

```
#cc -O -o pcnfsd -DPS630_IS_FIXED pcnfsd.c
```

Then install the resulting `pcnfsd` binary on each print server as described in Chapter 4, *"NFS Server Issues."*

Printer Hot key Cautions

Note these problem areas when you consider configuring a hot key sequence.

1. Do not use a printer Hot key sequence if you are using Microsoft Windows or WordPerfect™. These products filter keystrokes so results are unpredictable. Do not use a printer Hot key sequence with any product that filters keystrokes.
2. Likewise, do not use a printer Hot key sequence if you are using a SunIPC. Using a printer Hot key sequence causes delays in character echo on a SunIPC.

PC-NFS LifeLine Backup

If you have purchased *PC-NFS Lifeline*, you can find troubleshooting information for *PC-NFS LifeLine Backup* in the manual that comes with that package.

Application Notes

6

If you have a problem getting an application to work with PC-NFS, this chapter might offer a solution or some helpful advice. If your problem is not mentioned here, try checking Chapter 5, *Troubleshooting PC-NFS*.

This chapter contains notes on the following applications:

`COMP.COM` in different DOS versions
The `DIR` command under DOS
1DIR™ from Bourbaki Incorporated
dBASE III™ from Ashton-Tate
DESQview™ from QuarterDeck (Versions through 1.21)
Framework™ from Ashton-Tate
GEM™ (Version 1.2) from Digital Research
IBM FILEFAC™ and Excelerator™
Lotus 1-2-3
Microsoft Basic Interpreter® (Version 3.0)
Microsoft Windows (Version 1.4)
Microsoft Windows (Version 2.0)
Microsoft WORD® (Version 4.0)
MIT t-shell
MultiMate™ from MultiMate, International, an Ashton-Tate Company
Norton Utilities (Version 3.1)
Smartcom II® (Version 2.1) from Hayes
TREEd (public domain program)
WordPerfect (Version 4.1) from SSI Software
Wordstar (Version 3.21) from Micropro
Wordstar 2000 Plus™ (Version 1.01) from Micropro

COMP.COM in MS-DOS and PC-DOS

The file compare utility COMP.COM supplied with some MS-DOS implementations will display the message "Access denied" when both files or directories being compared are on PC-NFS networked drives. This problem does not exist with COMP.COM as supplied with IBM PC-DOS. To see if you have the problem, try the following command:

C>**COMP** *n:file.ext n:file.ext*

where *n:* is any networked drive and *file.ext* is any file on the drive. If the comparison is successful, then the problem does not exist with your version of MS-DOS. Your version of MS-DOS *does* have the problem if you receive an Access denied error.

To get around this problem, you can copy one of the files to a local drive before comparing them, or you can obtain a copy of IBM PC-DOS that does not have the problem. Unfortunately, PC-NFS cannot support both versions of COMP.COM simultaneously.

The DIR Command in DOS

The output from the DIR command under PC-NFS may differ from what you are used to. Under PC-NFS, the volume label field displayed by the DIR command identifies the network node whose disk contains your current directory.

Note that the disk free space values returned by the DIR command may not coincide with those from the UNIX df(1) command.

Finally, you might discover that you can't delete a directory, even though the DIR command display indicates that the directory is empty. This may be because the directory contains files whose names begin with a dot (.), which PC-NFS considers to be DOS *hidden files.*

To display these files in a directory listing, use the PC-NFS command: ls -a.

Another reason you may not see files is that the owner has set the file permissions so that the files are unreadable by you. DOS doesn't treat files that you can't access as normal files.

XCOPY.EXE in DOS 3.3

Users of DOS 3.3 should be aware that there is a bug in XCOPY whereby it may incorrectly compute buffer and data transfer sizes when dealing with large file systems, such as those which you may work with in PC-NFS. Occasionally this will cause the PC to hang. The problem is apparently resolved in DOS 4.0.

1DIR from Bourbaki Incorporated

Bourbaki Incorporated's 1DIR *cannot* be used on network drives. Every line of the file window will show the volume label (i.e. the server name). The solution to this problem is being researched for a possible future release.

dBASE III from Ashton-Tate

If you try to append records to a remote drive that is *read-only*, an error message appears, similar to the following:

```
General Failure error writing drive X.
```

The message provides two options, `Abort` and `Fail`. However, whichever option you choose, the error message continues to display. To exit the error message loop you must reboot your PC by pressing the Ctrl, Alt, and Del keys simultaneously.

DESQview from QuarterDeck

If you try to run `telnet` under older versions of QuarterDeck's DESQview, your system will hang. This is due to a bug in DESQview that prevents any program compiled with Microsoft C Version 3.0 from executing another program. The bug is known to exist in versions of DESQview through 1.21. A patch (too complex to be included here) has been developed for DESQview 1.21 and posted to `net.micro.pc` on the *Usenet*. You should check with QuarterDeck to see if your version of DESQview fixes the problem.

Due to the way DESQview handles the keyboard, you cannot start a `telnet` session, suspend it, start up DESQview, and then "Hot key" into `telnet`. Instead, use it in a separate DESQview window.

Framework from Ashton-Tate

Framework always sets the highest disk drive as the default drive in DOS. This setting can cause a problem because the highest drive might not be *mounted* by PC-NFS, though DOS recognizes the drive.

Framework documentation suggests a fix to avoid this problem. The user must edit the CONFIG.FW file that accompanies Framework. Specifically, the user must alter the DEFAULT_DRIVE line and change the value from 0 (zero) to an actual drive name, such as `C:`.

GEM (Version 1.2) from Digital Research

When you run Digital Research GEM, you can print files on a Sun LaserWriter. Choose the *Apple LaserWriter* option when installing GEM and make sure that you run your configuration program and select *PostScript mode*. You can print many graphic images at once with GEM. While PC-NFS does support this, we recommend that you limit the number of graphic images spooled to the printer, because space may be limited on the print server.

The GEM driver does not generate a PostScript header. Configuring it to work with a redirected printer that you have set into PostScript mode works correctly. The GEM Output subsystem buffers a considerable amount of data internally, and if you do not disable printer time-outs or select manual print initiation, you may find output being split with unpredictable (and generally disastrous) results. For the above reasons do not accept the default printer mode. Instead select printing using `net print`. In this mode, spooling will not be initiated until you exit from the GEM Output subsystem and type **`net print *`** to flush the buffer and queue the file on the remote printer.

IBM FILEFAC and Excelerator

If you use PC-NFS with Excelerator alone or with IBM's FILEFAC alone, there are no conflict problems. However, if you use all three programs simultaneously, you must use them in a particular order. PC-NFS must be loaded first. Then, you must load Excelerator, followed by FILEFAC.

1-2-3 from Lotus Development Corp.

The PostScript drivers contained in the Lotus 1-2-3 Value Pack do not work with PC-NFS. However, Sun servers provide the same features. To use these features:

1. Configure 1-2-3 for a dumb printer
2. Configure PC-NFS for `Standard Text`

Microsoft BASIC Interpreter (Version 3.0)

If you are running Microsoft Interpreter BASIC and you press Ctrl Break while PC-NFS is processing a remote file request, BASIC reports a "`Device I/O Error`." This error message is merely a side effect of the way PC-NFS processes fatal error exceptions. Therefore, in spite of the message, pressing Ctrl Break halts the application correctly. From that point, you can use the BASIC command `CONTINUE` to proceed normally.

Microsoft Windows

The following information applies to Microsoft Windows versions 1.0, 2.03, and Microsoft Windows/386 version 2.01, unless otherwise noted.

DOS Compatibility

To operate correctly with Microsoft Windows, PC-NFS requires DOS version 3.2 or later.

Installation

You cannot use the `SETUP` program supplied with Microsoft Windows to install Windows successfully on a networked drive. To install and use Windows on a networked drive:

1. Install the program on a local hard drive.
2. Copy the files from the local directory where you installed Windows to a directory on a remote (networked) drive.

Accessing Printers

It is recommended that you turn Microsoft Windows spooling OFF when using PC-NFS.

Configuring PC-NFS for Printing with Windows

The `Enable printer Hot key` PC-NFS configuration option does not work with Microsoft Windows.

If you choose the `After 5 minutes` option or the `On Program Exit` option when you configure PC-NFS printing, your output prints when you exit from the program you are printing from, or *any other active program.* Therefore, if you select either of these options, you should not exit any programs while printing, or should select a different print spooling option, such as `NET PRINT only` or `5 minute timeout`.

Running PC-NFS Utilities

The PC-NFS utilities that you can run from a Windows window depend on your systems configuration. To run PC-NFS utilities and configuration programs in a Windows window, create a `.PIF` file which calls `COMMAND.COM` as the `executable`, and uses the PC-NFS utility that you want to run as the `parameter`. See the *Using Microsoft Windows* manual.

Display Clipping

In Windows version 1.4, the "MS-DOS Executive" window has the first few pixels on the left side of the display cut off if you have drives up through and including disk drive `S` in use.

The display clipping in the "MS-DOS Executive" window has been fixed in Windows 2.0.

Using `telnet` with Microsoft Windows

You can use `telnet` with Windows in two ways:

1. Start a `telnet` session before running Windows, then exit leaving `telnet` resident in memory. Later, you can reactivate the `telnet` session from within Windows or after you have exited Windows. Note that you cannot remove `telnet` from memory while Windows is active.
2. Start a `telnet` session from within Windows, then return to Windows leaving `telnet` resident in memory. You can reactivate the `telnet` session from within Windows at any time.

However, you should know that when you start `telnet` this way, you can't remove it from memory. In addition, when you exit from Windows, `telnet` *remains* in memory. This in turn causes DOS memory fragmentation, which greatly limits the space available for running applications.

Creating a Program Information File for `telnet`

Before running `telnet` under Windows, it is necessary to create a Program Information File (`PIF`) for `telnet`. From the initial Windows screen, do the following:

1. Double-click on the `PIF` directory to open it.
2. Double-click on the program `PIFEDIT.EXE`.
3. Verify that the cursor (the blinking vertical bar) is in the "`Program Name`" field.
4. Type *x*:**`\NFS\TELNET.EXE`** (replace *x* with your PC-NFS drive, such as **C**).
5. Point and click in the "`KB desired`" box. Use the BkSp key to remove the existing value and type **0**.
6. In the "`Directly Modifies`" section, select "`Screen`," "`Memory`" and "`Keyboard`." If you intend to use `telnet` over an asynchronous link, select "`COM1`" or "`COM2`" as appropriate.
7. In the section "`Program Switch`," select "`Prevent`."
8. Open the "`File`" menu and select "`Save`."
9. Exit from `PIFEDIT` by "Closing" it.

You can now run `telnet` by changing to the `\NFS` directory on your drive and double-clicking on `TELNET.PIF`. If `telnet` is not resident, you will see the usual startup menus. If `telnet` is resident, the program asks you if you want to resume the session.

`Telnet` Restrictions

Due to restrictions in Windows, you cannot do the following:

1. Use the Hot key to re-enter `telnet`. You must use the `telnet` program to do this. (This is why you cannot remove `telnet` once you have loaded it under Windows.)
2. Specify a host name in the `Program Parameters` section of the `PIF`. Actually you *can* specify one, but Windows will convert the name to upper-case, which will usually result in failure. (Most host names are lower-case.) You should therefore leave the `Program Parameters` section of the `PIF` blank.
3. Change an existing session with Windows loaded. If you run `telnet` and see the menu:

   ```
   Do you want to resume the current session

     A. Yes - resume the current session
     B. No  - open a new session
   ```

   you should *not* select `B`. If you do, and you then select a host, you will see the error messages

   ```
   NFS079F : PC-NFS Network Library Error #2004
   NFS102W : host is not a valid hostname.
   ```

   You should then press any key (as requested) and select F10 to cancel. Your `telnet` session will still be active.

Creating a Program Information File for `ftp`, `rcp`, and `rsh`

The PC-NFS utilities `ftp`, `rcp`, and `rsh` modify memory. Therefore, to run any of these programs from Microsoft Windows, you need to indicate this in the Windows Program Information File. Follow the instructions in the previous section on "Creating a Program Information File for `telnet`." In the "`Directly Modifies`" section, select "`Memory`."

Microsoft WORD (Version 4.0)

If you want to use Microsoft WORD in a networked PostScript printer environment, you have to change certain WORD PostScript initialization files. The files are: POSTSCRP.INI (for portrait mode printing) and POSTSCRL.INI (for landscape mode printing). You have one or both of these files depending on how you installed WORD. The following instructions refer to editing the POSTSCRP.INI file; if you installed WORD for landscape mode, follow the same instructions using the POSTSCRL.INI file.

1. Copy POSTSCRP.INI to POSTSCRP.OLD. In WORD, edit POSTSCRP.INI to make three changes:
2. Comment out (make inactive) two lines at the beginning of the file by adding a percent sign in front of them so they look like this:

```
%userdict /msdict known {stop} if
%serverdict begin 0 exitserver
```

3. Delete or overwrite with spaces the words "currentfile closefile" which appear in the file on this line:

```
/PSe {restore end currentfile closefile} def
```

   After deleting the words, the line looks like this:

```
/PSe {restore end} def
```

4. Delete the last character in the file. The last character is a Ctrl D, which looks like a diamond if you're editing the file in WORD.
5. Save the file without formatting. This initialization file is now network compatible.

Now, use nfsconf to mount a network Postscript printer. Select PostScript as the printer type.

When you want to print, you can either print directly to a network printer or print to a file and then NET PRINT the file.

To print directly to a printer, print as if the printer is directly connected. What you select for your Start Print option determines when the output is actually spooled to the printer.

If you want to print to a file and later use NET PRINT, you print the appropriate initialization file before your file in the same NET PRINT command. For example, if you print to a file MYFILE.PS in your WORD directory, are in portrait mode, and are using LPT1: as your network PostScript printer, you issue the command

```
NET PRINT POSTSCRP.INI MYFILE.PS LPT1:
```

to print the file.

MIT t-shell

When you use `telnet` to connect to a host running the MIT t-shell, some characters are lost or replaced by a bell character. This is because the t-shell uses Ctrl S for the search function. `telnet` (like many terminals) uses Ctrl S and Ctrl Q for flow control. You can, however, configure the t-shell to use some other character for the search function. You can also disable `telnet`'s use of Ctrl S and Ctrl Q by selecting the `Xoff` item on the `Change Parameters Menu` described earlier in this chapter.

MultiMate

If you load MultiMate into a subdirectory on a network disk and run it from there, the first screen is somewhat distorted.

Norton Utilities (Version 3.1 and 4.0)

Norton Utilities that attempt to perform physical disk reads do not work on networked drives. (*NU* is one such utility). Physical disk reads that fail produce the message "`Error 1`." Other Norton Utilities work fine.

Smartcom II (Version 2.1) from Hayes

Hayes Smartcom II supports logical disk drives up to the letter `P` only. You should therefore avoid accessing the spool drives (`T`, `U` and `V`) or assigning networked drives beyond `P` when running this application.

TREEd

The public domain program TREEd crashes the system when used with PC-NFS. This is due to a bug in TREEd. When it gets an error from a "4E" system call, it does not clean up the stack properly and branches to a random address, thus crashing the system.

WordPerfect (Version 4.1 and 5.0) from SSI Software

WordPerfect from SSI software may not work properly if you start the program from a directory other than the one in which it was installed. If you encounter an error trying to load WordPerfect, type in the full path to the `WP.EXE` file when WordPerfect prompts you. WordPerfect will then patch itself and work correctly.

When printing, WordPerfect may be used with the Diablo emulation mode. However if you select `Diablo 630 ECS` from the printer menu, problems may arise since the program occasionally generates unsupported command sequences. Selecting `Diablo 620` works better.

Most likely you will want to use `PostScript` mode (both WordPerfect and PC-NFS) if your server has a PostScript printer.

Wordstar (Version 3.21) from Micropro

If you plan to use Micropro Wordstar with a Sun LaserWriter, we recommend that you configure the program to use a Diablo 630 printer and then use the PC-NFS configuration program to set the network printer to `Diablo 630` mode. Use form feeds instead of line feeds at the ends of pages in documents that you plan to print on the LaserWriter.

Wordstar 2000 Plus (Version 1.01) from Micropro

Micropro Wordstar 2000 Plus requires more files than PC-NFS supports by default. You can change the maximum number of files that PC-NFS supports by adding the `/f`*n* switch after the `PCNFS.SYS` entry in your `CONFIG.SYS` file. In order to run Wordstar 2000 Plus properly, you must increase the maximum number of files to at least 20.

PC-NFS Technical Reference

7

PC-NFS Interaction With the DOS Run-Time Environment

When PC-NFS is installed on your PC, it is effectively "intertwined" with DOS. It links itself to the interrupt vectors to interpret DOS calls and I/O requests. This section describes the effects an installed PC-NFS has on the DOS operating environment: how it uses the vectors, memory and drivers.

System Call Interception

PC-NFS intercepts all operating system calls from applications and decides whether or not the particular call applies to an NFS file or to a local DOS file. If the call applies to a file on an NFS server, the PC-NFS device driver handles the call and returns control to the application program. The application program does not know that the file is on a network disk since the results that the device driver returns to the application are the same as if DOS had handled the call.

Three Device Drivers. The operational part of PC-NFS consists of three device drivers:

1. A communications controller driver, which manages the Ethernet interface (`3C501.SYS`, `3C505.SYS`, `NFSVEC.SYS`, `NIC.SYS`, `NI5010.SYS` or `WD8003E.SYS`). Note that in some cases more than one DOS driver is required.
2. `PCNFS.SYS`, which handles the function calls from applications
3. `SOCKDRV.SYS`, which handles *read*, *write* and *close* calls on sockets

The appropriate communications controller driver, the `PCNFS.SYS` driver, and the socket driver `SOCKDRV.SYS` are installed by the `CONFIG.SYS` file that is read by DOS at boot time. When the first `net` command is executed,

PC-NFS intercepts the DOS function call vector INT 21H so that it can process all DOS function calls. Any call that does not pertain to a network disk file is passed on to DOS via the old vector value.

DOS Function Call Vector

When the application issues an INT 21H function call, control passes to the INT 21H entry point in `PCNFS.SYS`. This saves the user's registers and resets the stack pointer and segment. This also saves interrupt vectors 23H, 24H, and 1BH and installs new vectors that point to PC-NFS code. Function call that deal with a network disk invoke the PC-NFS service module to process the DOS function by issuing NFS calls via the network layer. Otherwise the request passes on to DOS via a long call to the original INT 21H vector. Returning control from DOS or the PC-NFS service module, restores interrupt vectors 23H, 24H, and 1BH and passes control back to the application.

Printing and the Print Vector

Printing to a remote printer is accomplished by installing a small resident program, `PRT.EXE`, that intercepts all calls to the ROM BIOS print vector INT 17H. The `install` program puts a `PRT *` line in the `AUTOEXEC.BAT` file. Characters that are being redirected to a remote printer are buffered and then sent to the remote file server using a DOS write call to a spool file on the server. The spool file on the server is printed when one of four events occurs:

1. When an application terminates
2. After a 5-minute delay
3. When the printer hot-key is pressed
4. When the user issues a `net print * lpt`*n*`:` command.

Some or all of these may be enabled under user control by the configuration program.

Printing is initiated via a Remote Procedure Call to the `pcnfsd` server daemon running on the print server. Any program that prints by directly manipulating the hardware of the printer interface will not be able to print to a remote printer.

Other Interrupt Vectors

Because DOS is non-reentrant, several other interrupt vectors are intercepted by `PCNFS.SYS` at various times during function calls. The typical sequence of operations is discussed below.

DOS Control-Break Exit. Interrupt 23H is the control-break exit address vector. DOS issues an INT 23H instruction if the user hits Ctrl Break (or Ctrl C) during certain function calls. PC-NFS needs to know if an INT 23H was issued so that internal data structures can be cleaned up if the application elects to terminate the current process. The sequence of events when DOS issues an INT 23H is as follows:

When DOS issues INT 23H, control passes to a routine in `PCNFS.SYS`. If the PC-NFS stack is in use at the time, the user's stack is restored. The old value of the interrupt 23H vector is restored and PC-NFS issues an INT 23H instruction. This transfers control to whatever the old INT 23H vector pointed at. Occasionally this will be an application that intercepts the INT 23H vector; however in most cases, it is the command interpreter `COMMAND.COM`. If control returns to PC-NFS from the INT 23H call, PC-NFS determines whether to terminate the current process or to allow the program to continue by restarting the original DOS call. Control may not return to PC-NFS since the called program may restart itself.

Avoid Using Trapped Vectors. The user's program should never issue INT 23H directly, because internal data structures in PC-NFS may be left in an inconsistent state and may cause subsequent processes to fail. (Programs may, for example, be unable to open files due to file control block starvation.)

The DOS fatal error INT 24H is also intercepted for basically the same reason: PC-NFS needs to know if a process has terminated or wants to restart the DOS call that caused the trap.

Control-Break, Timer and Print-Screen. The ROM BIOS calls Interrupt 1BH whenever Ctrl Break is pressed on the keyboard. PC-NFS traps this vector so that the user can break out of some types of network failure. If a server or network failure causes PC-NFS to wait in a loop, retrying a request, the user can use Ctrl Break to signal to PC-NFS that the function should be aborted.

Interrupt 08H, the *timer interrupt*, is intercepted when PC-NFS is initialized. This interrupt is used to implement several timer-based functions within PC-NFS, such as the scheduling of replies to ARP requests. If the user program intercepts this interrupt, it must pass control to the intercepted value to allow PC-NFS (and system timers) to operate properly.

Interrupt 05H is the *print screen function interrupt*. As with Interrupt 08H, it is intercepted when PC-NFS is initialized, rather than on every INT 21H call as are the above interrupts. This interrupt is generated by the ROM BIOS whenever the Shift PrtSc keys are hit. In order to avoid a recursive

PC-NFS call, a flag is set whenever the ROM requests a print of the screen. This flag is checked at certain points in the PC-NFS code to see if a call to the old vector is needed to print the screen.

Summary of Vector Use

The following table summarizes which vectors PC-NFS intercepts, when, and why.

Table 7-1 *Interrupt Vector Use Summary*

Vector	Function	When Intercepted	When Restored
05H	Print Screen	At installation	—
08H	Timer	At installation	—
17H	Print Character	First `net use lpt`*n*`:...`	—
1BH	Ctrl-Break Key	Each INT 21H call	INT 21H function completion
21H	DOS Function Call	At installation	—
23H	Ctrl-Break Exit	Each INT 21H call	INT 21H function completion; internally if DOS issues an INT 23H
24H	DOS Fatal Error	Each INT 21H call	INT 21H function completion

Typical Memory Map

The following memory map shows the typical layout of a PC running PC-NFS. Note that it gives the general order of code in the PC, not the actual memory locations, which can differ from machine to machine.

Table 7-1 *Typical Memory Map*

Address	Start of:
0000:0000	Interrupt vector table
0040:0000	ROM BIOS data area
0050:0000	DOS communications area
xxxx:0000	DOS system files
xxxx:0000	Device drivers, including `ANSI.SYS`, `PCNFS.SYS`, the Ethernet driver and `SOCKDRV.SYS`
xxxx:0000	`COMMAND.COM`
xxxx:0000	Resident programs; for example, Sidekick, Turbo Lightning™
xxxx:0000	Application programs

`PCNFS.SYS` is approximately 75 Kbytes in size (after allocating buffer and cache structures at initialization time), while the board drivers, except for the 3C505 board, occupy less than 10 Kbytes. The 3C505 board driver occupies about 25 Kbytes. Note that correct operation of the PC-NFS support programs requires that the `ANSI.SYS` driver be installed.

The socket driver, `SOCKDRV.SYS` is about 1 Kbyte in size.

Communication Controller Parameters

When configuring your communication card, you must determine its I/O port address or shared memory address in order to determine its Ethernet address. The information needed depends on the type of controller, as follows:

Table 7-1 *Communications Controller Types*

I/O Port Address	Shared Memory Address	None
3C501	NIC	
3C503		3C523
3C505		
NI5010		
WD8003E	WD8003E	

The following table shows the acceptable ranges for these parameters:

Table 7-2 *Communications Controller Parameter Ranges*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	2-7	200H-3F0H	----
3C503	2-5	250H-350H	----
3C505	3-7,9 (PC) 3-7,9-12,14,15 (AT)	200H-3F0H	----
NI5010	3 or 5	200H-3E0H	----
NIC	2-7	----	8000H-F800H (512K) - (992K)
WD8003E	2-7	200H-3E0H	8000H-F800H

The default settings for these parameters are as follows:

Table 7-5 *Communications Controller Default Parameters*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	3	300	----
3C503	3	300	----
3C505	3	300	----
NI5010	3	300	----
NIC	2		D000H
WD8003E	2	280	D000H

Table 7-6 *DMA Values and Transceiver Types*

Board	DMA Values	Default DMA Value	Default Transceiver Type
3C503	1, 2, 3	1	thin
3C505	0, 1, 3 (AT 8 bit) 5-7 (AT 16 bit)	1	

First, find out whether the controller was installed with factory settings (the default), or whether it was reconfigured to use a different I/O port address or shared memory address. If you don't know, assume default factory settings.

There is no way, using software, to find the I/O port address or shared memory address. You must get that information from the person who installed the board, or inspect the board yourself.

The following table shows which devices use which Interrupt ReQuest (IRQ) lines. Not all of these devices may be present on your system.

Table 7-7 *Hardware Interrupts Already In Use*

Interrupt Level	PC, PC/XT	PC/AT
IRQ2	—	can't use
IRQ3	(COM2:)	(COM2:)
IRQ4	(COM1:)	(COM1:)
IRQ5	(hard disk)	—
IRQ6	(diskette)	(diskette)
IRQ7	(printer)	(printer)

Conflicts can occur with: mice, modems, serial ports, or multifunction cards. You can use any IRQ which is not already used by another device on your system.

NFS Support for DOS File Attributes

Each DOS file name has a file attribute byte associated with it. DOS uses six bits of this byte to track information about the file or file name. PC-NFS uses NFS permissions and the NFS file system to support these attributes wherever appropriate.

The DOS file attribute byte has the following bit mapping:

Table 7-8 *DOS File Attribute Byte*



- read-only bit (bit 0)
- hidden bit (bit 1)
- system bit (bit 2)
- volume-label bit (bit 3)
- subdirectory bit (bit 4)
- archive bit (bit 5)
- unused (bit 6)
- unused (bit 7)

PC-NFS creates a file attribute byte to emulate DOS files as follows:

- PC-NFS read-only files act exactly like DOS read-only.
- PC-NFS hidden files act exactly like DOS hidden files.
- PC-NFS does not support the DOS system bit.
- PC-NFS returns the server network name as the volume label for the requested NFS disk.
- PC-NFS subdirectories act exactly like DOS subdirectories.
- PC-NFS always sets the archive bit on. Because this bit is always on, you cannot do an incremental backup. Using the `/M` option to invoke the DOS `BACKUP` command results in a full backup.

PC-NFS File Locking

The *DOS 3.1 Technical Reference* states that if a file is closed while record locks are in force, the effect is undefined. To make this behavior predictable PC-NFS releases all locks on a file when the file is closed.

It also cautions you to not rely on read or write being denied for a locked range. Instead, you should use explicit locks around any critical byte ranges in a file. The DOS `ATTRIB` command cannot be used to change the archive bit of files on mounted file systems. PC-NFS always sets this bit. This is a restriction in the PC-NFS implementation.

The *DOS 3.1 Technical Reference* also states that you must release a record lock by unlocking exactly the same range that you locked. PC-NFS, however, permits unlocking *part* of a locked range. For example, if you lock bytes 1 to 10 and then unlock bytes 3 to 6, you will be left holding two locks for bytes 1-2 and 7-10.

Customizing PC-NFS

As an aid to future internationalization, PC-NFS, like most programs, does not include the various messages, display formats, and so forth within the program; instead, PC-NFS reads these from the file `\NFS\pcnfs.msg` on a drive determined as follows:

1. If the environment variable `NFSDRIVE` is defined, its value is used as the drive letter.
2. Otherwise, if PC-NFS has been installed, the current drive at the time of the installation is used.

This method is also used to locate `telnet` and the printer configuration files, as well as databases such as `\NFS\HOSTS`. You should bear this in mind if you plan to create a customized configuration, and make sure that the PC-NFS utilities can always locate these files.

Printing

Zero-Length Spool Files

A new file is created in the printer spool area of the server every time a command of the form:

`C>`**`net use LPT`***`n`*`:`** `\\`*`server\printername`*

is used. This file initially has a length of zero and grows as the PC sends it printer output. This zero length file remains even if you reboot the PC.

Your system administrator can arrange for such files to be removed periodically. However, if you want to delete any leftover files each time you boot your PC, edit your `\NFS\DRIVES.BAT` file, replacing the line

`net use LPT1: \\`*`host\printer`*

with the lines

`net use LPT1: \\`*`host\printer`*
`DEL T:*.`
`net use LPT1: /d`
`net use LPT1: \\`*`host\printer`*

For `LPT2` and `LPT3` use `DEL U:*.` and `DEL V:*.` respectively. Note if use the `nfsconf` program to change or remove this printer as a default for startup, the extra commands may cause errors.

Adding a Serial Printer to a Server

Most PC applications support the IBM Graphics Printer or Epson MX-80/FX-80™ printer. Adding an Epson printer to the NFS server is a relatively easy procedure.

To add an Epson printer as a spooled printer on a Sun server, make sure you have a serial interface installed on the printer that is capable of supporting Ctrl-S/Ctrl-Q handshaking. Follow the instructions in the *Systems Administration Manual for the Sun Workstation.* Chapter 5.5, *Hooking Up a Serial ASCII Printer*, covers the points needed to get UNIX to recognize the new printer.

The following is a sample `/etc/printcap` file entry:

```
ep|epson|fx286:\
:lp=/dev/ttya:sd=/usr/spool/ep:br#9600:fs#06020:fc#0300:\
        :xs#040:lf=/usr/adm/epd.errs:
```

Networks

Internet Subnet Support

This section discusses PC-NFS support for Internet subnet addressing. *Subnetting* is a mechanism that makes more efficient use of the Internet addressing scheme. It was first introduced in the 4.3BSD Berkeley UNIX release[1], and is now supported by several TCP/IP implementations, including SunOS from Release 3.3 onward and PC-NFS Release 2.0 onward.

This section describes how Internet addressing works and what role subnetting plays. This section also includes a description of how subnetting fits in with PC-NFS. For specific information about the `net subnet` command, see the chapter, "Commands Reference," in the *PC-NFS User's Manual.*

A Short Treatise on Internet Addressing

Every computer connected to a TCP/IP network is identified by its Internet address. (Note that a gateway system may have two or more addresses, each corresponding to a distinct network to which the gateway is connected.) This IP address is a 32-bit unsigned integer that is conventionally broken into four 8-bit fields (octets). The value of each field is given in decimal, as, for example:

```
192.9.200.3
```

There are three classes (formats) of Internet address: A, B and C. The format defines which octets in the address identify:

1. The network to which the computer is connected (the *network number*)
2. The particular machine on that network (the *host number*).

[1] Following a scheme described by Mogul and Postel in the DOD document RFC950.

The format is determined by the value of the first octet, as follows:

Class A: octet 1 is from 1 to 127:

network no.	host no.	host no.	host no.

Class B: octet 1 is from 128 to 191:

network no.	network no.	host no.	host no.

Class C: octet 1 is from 192 to 254:

network no.	network no.	network no.	host no.

For example:

64.0.1.63 is a class A address. The network number is **64.0.0.0** and the host number is **0.1.63**.

131.12.14.207 is a class B address. The network number is **131.12.0.0** and the host number is **14.207**.

193.17.63.12 is a class C address. The network number is **193.17.63.0** and the host number is **12.**

The problem with this addressing scheme is that small networks lead to wasted Internet addresses. Consider an organization with two small Ethernets, one with 6 nodes, the other with 12. These Ethernets are not expected to grow bigger. Assume that class B addressing is used, with network numbers **128.10.0.0** and **128.9.0.0**. Even allowing for the fact that host numbers **0.0** and **255.255** are illegal, there are still *131,050* unused — and unusable — addresses. With class A networks, the problem is much worse, and even class C networks are not immune.

Subnet addressing can remedy this situation. In a subnet scheme, the host number is split into two fields: the *subnet number* and *host-in-subnet number*. This split is defined by the subnet mask, a number that selects which bits in the Internet address comprise the network number and subnet number. Networks with the same network number but different subnet numbers are considered to be distinct networks.[2]

In the preceding example, we could specify that the third octet was to be the subnet number and call the two Ethernets **128.9.1.0** and **128.9.2.0**. This would use only one valuable class B network number.

[2] There are certain restrictions on this. In particular, all subnets of a specific network are normally connected to the outside world through a single gateway; outside that gateway the subnet structure is transparent. For more details consult RFC950.

The subnet mask can be specified in two ways: as a hexadecimal number, or in the Internet "dotted" notation. Therefore, in the preceding example, we could specify the subnet mask as **0xffffff00** or **255.255.255.0** (these are equivalent). Although it is usual to allocate one or two bytes to the subnet number, the pattern can be arbitrary. For example, in a class C network the mask **0xfffffff0** specifies that the high order four bits of the fourth octet are the subnet number (from 1 to 14 — all-0s and all-1s are disallowed) and the low order four bits are the host number. Non-contiguous bit fields can be used, but are not recommended.

Unlike the basic Internet address class structure, subnet addressing is not self-describing. Therefore it is essential that all nodes on the network agree on the subnet mask. Two mechanisms are supported: direct assignment and ICMP inquiry.

With direct assignment, the mask is set from a system configuration file. In SunOS or 4.3BSD UNIX, it can be set by the `ifconfig(8)` command (usually through the `/etc/rc.local` startup file). At least one node must set the mask in this way, normally the primary gateway on the subnet.

To avoid having to hard-code this information into every node, a system can broadcast a request with the ICMP protocol, asking if any other node knows what the mask is. Any designated gateway that knows the mask can respond to this inquiry.

Subnet Support in PC-NFS

In PC-NFS the `net subnet` command is used to set the subnet mask. This command is fully described in the chapter "Commands Reference" of the *PC-NFS User's Manual.*

You cannot set the subnet mask until the PC's Internet address has been established by the `net start rdr` command. For this reason, if subnetting is in use, it is usual to add a `net subnet` command to the `\NFS\NETWORK.BAT` file immediately after the `net start rdr` line. For network management convenience, the `net subnet *` form is preferred.

Note these two restrictions:

1. If both Yellow Pages and Reverse ARP are used, the Yellow Pages server used during the `net start rdr` process *must* be on the same subnet as the PC. If it is not, the PC might be unable to communicate with the server.
2. A PC running PC-NFS will never respond to an ICMP address mask inquiry.

Annotated Error Messages

A

System Error Messages

PC-NFS system messages are preceded by a string of the form

NFS*nnnt*

where *nnn* is the message number and *t* classifies the message as "Informative", "Warning", or "Fatal error". Where possible, PC-NFS displays the key variable information in **bold**.

If you encounter an error that you don't know how to correct, simply jot down the code, and any **bold** fields if appropriate. This information will make problem reporting and troubleshooting much quicker and more accurate.

Each message is discussed below, in numerical order.

NFS000F : PC-NFS is not installed or has been disabled.

Either PC-NFS was never installed, or it has been disabled due to a license violation.

NFS001F : **utility_program**: PC-NFS was not installed correctly.

You ran one of the PC-NFS utility programs that interacts with the resident part of PC-NFS, but it couldn't find PC-NFS. Either PC-NFS was not configured into the system (check the CONFIG.SYS file), or the installation process failed (which would have resulted in an earlier error message). The utility_program is terminated.

NFS002F : Unknown host. 'net start rdr hostname *' must be issued.

You tried to issue a net command that depends on PC-NFS having been started. The program assumed that you were operating in an environment that has Yellow Pages or Reverse ARP and it tried to use them to start PC-NFS. However the program was unable to determine the name and Internet address of the PC, and was unable to start PC-NFS. If you really meant to start up PC-NFS in this way, check with your network manager that the Reverse ARP and Yellow Pages services are active.

NFS003F : This command is illegal while there are mounted filesystems.

The command net stop rdr cannot be used while your system has mounted file systems. Use net use to determine which file systems are still mounted, dismount them with:

```
net join drive /ed
```

Now reissue the command.

NFS004W : Network is already started.

You issued a net start command when PC-NFS had already been started. PC-NFS ignores this command.

NFS005F : Authentication failure.

The pcnfsd daemon rejected the user name and password you gave in a net name command. Either the user name was unknown, or the password you gave was incorrect. Your user identity is left as nobody.

NFS006F : **string** is not a valid drive specification.

The command required that you specify a drive name by giving a valid drive letter followed by a colon. The string you gave is incorrect.

NFS007F : **string** is not a valid path specification.

The command required that you identify a remote file system directory with a string of the form \\hostname\dir1\dir2... or hostname :drive unit:[path] for VMS (for net use) or \dir1\dir2... (for net join). The string you supplied does not have the correct form.

NFS008F : Drive **d:** has not been mounted.

This message is usually preceded by one or more error messages indicating that a net use command could not be processed correctly. This message merely confirms that drive d has not been mounted.

NFS009F : JOIN failed : no room in JOIN table.

You issued a net join command, but PC-NFS had run out of internal space to record the join. The join was not performed.

NFS010F : JOIN failed : device busy.

You issued a net join command, but the drive you specified is already joined elsewhere. (Use net join to see what joins are in force.) The join was not performed.

NFS011F : JOIN failed : the path must identify a directory, not a file.

In a net join command, the path must identify a directory to which the drive is to be joined. The path you gave identifies a file instead.

NFS012F : JOIN failed : both the path and drive must be NFS resources.

You cannot use net join to join a DOS drive to a PC-NFS directory or vice versa.

NFS013F : JOIN failed : pathname is too long.

PC-NFS holds the directory path for a join in an internal "join table." The path you gave was too long to fit into the table. There is no obvious workaround, other than revising the topology of the tree you are trying to establish.

NFS014W : Device is not joined.

You tried to use net join d:/d to dismount a device that wasn't joined.

NFS015F : Unknown JOIN error code NNN.

An unexpected internal error occurred in the PC-NFS join subsystem. If this error recurs, contact Sun Microsystems Inc.

NFS016I : The PC-NFS Version is NNN.

This message is produced as a result of the net version command.

NFS017I : 'TZ' not set in environment. Pacific Time (PST8PDT) assumed.

PC-NFS needs to know what the local time zone is, and whether daylight savings time is in use. This is because UNIX uses Greenwich Mean Time for all time stamps, while DOS uses local time. PC-NFS uses the standard (Microsoft) technique for specifying this information: the environment variable `TZ` is set to a string of the form "xxxnyyy," where "xxx" is the name of the time zone, "n" is the (signed) number of hours west of Greenwich, and "yyy" is the name of the time zone to be used when daylight savings is in effect. (If daylight savings time is not used, "yyy" is left blank.) If PC-NFS finds that TZ has not been set in the environment, it issues this message and assumes Pacific Time with daylight savings time.

This error should not occur, since the PC-NFS installation program adds a line of the form "SET TZ=xxxnyyy" to AUTOEXEC.BAT.

NFS020I : Blip (on-screen network activity monitor) is disabled.

This message is produced as a result of the net blip command.

NFS021I : Blip (on-screen network activity monitor) is enabled.

This message is produced as a result of the net blip command.

NFS022F : **string** is not a legal UMASK: use a three-digit octal number.

To set the file creation permissions mask (the umask), you must give a permission code as a three-digit octal number. The string you gave was invalid.

NFS023I : The current UMASK is **NNN** (octal).

This message is produced as a result of the net umask command.

NFS024F : **name** is not the name of any known host.

PC-NFS tried to interpret name as the name of some system on the network (possibly the PC on which it was running), but failed. In a network environment, with Reverse ARP and Yellow Pages, this means that the name could not be found in the file \NFS\HOSTS; or it means that the name was not in the Yellow Pages hosts.byname map. This is normally treated as a fatal error by net or any of the PC-NFS utilities.

NFS025F : **hostname** is not a YP server for domain **domain_name**.

You used the net ypset command to specify the system to be used as a Yellow Pages server. However PC-NFS determined that hostname was down, or was not acting as a server for the given domain. If no other messages are displayed, Yellow Pages services cannot be used. However in most cases PC-NFS will try to recover by broadcasting to find a server (see below).

NFS026I : Searching for a YP server...

Either you issued a net ypset * command, or you tried to select a specific server with net ypset hostname and it failed (see above). PC-NFS is attempting to find a Yellow Pages server for the current domain.

NFS027I : Using Yellow Pages server **hostname**.

PC-NFS has identified that hostname is a Yellow Pages server for the current domain.

NFS028W : Unable to find a YP server for domain **domain_name.**

PC-NFS has failed to locate a system that can act as Yellow Pages server for the current domain domain_name. You should check that the domain_name is correct.

NFS029W : Unable to obtain the name of the YP server.

A server responded to PC-NFS's request for a Yellow Pages server for the current domain. However when PC-NFS tried to determine the server's name (by consulting the Yellow Pages map hosts.byaddr) it could not find an entry. This could be caused by a mismatch between the \NFS\HOSTS file on the PC and the hosts.byaddr Yellow Pages map; if this is not the case, ask your network administrator to rebuild the Yellow Pages database.

NFS030I : No gateway is currently defined.

This message is produced as a result of the net route command.

NFS031I : Non-local routing via gateway `hostname` (NN.NN.NN.NN)

This message is produced as a result of the net route command. NN.NN.NN.NN is the Internet address of the gateway system hostname.

NFS032I : The Yellow Pages domain is **domain_name.**

This message is produced as a result of the net ypdomain command.

NFS033F : Unable to contact PCNFSD daemon on server **hostname.**

You used the command net use printdev: ... to redirect print output to a printer on hostname. PC-NFS tried to call the pcnfsd daemon on the server, but the call failed. Check that the pcnfsd daemon is running on the server hostname.

NFS034I : Installing resident Print Redirector.

The first time you redirect printer output via NFS, PC-NFS invokes a small resident program to buffer print data.

NFS035F : Installation failed (DOS error #NNN).

Following message #34, this error message indicates that the resident Print Redirector is not installed. NNN is a DOS error code. Check that the program PRT.EXE is in the `\NFS` directory, and that `PRT *` is in `AUTOEXEC.BAT` just before the `NFSRUN` command.

NFS036F : Server **hostname** is not responding.

Certain PC-NFS Network Library routines issue this message when a request to the specified server has timed out. The most likely explanations are that the server or network is down, or that the server software has failed. Under certain conditions, PC-NFS might recover from this condition without terminating the command (see below); more often, the command will be terminated, possibly with other error messages.

NFS037I : Server **hostname** is o.k. now.

This message indicates that the problem reported in an earlier error message #36 (see above) has been corrected.

NFS038F : Access to file system denied by server.

You attempted to mount a remote file system with a net use command. Either the file system is not exported by the server, or you do not have permission to mount the file system. If you believe that the file system should be accessible, ask your network administrator to check the file /etc/exports on the server.

NFS039F : The NET USE failed (code NNN): *Explanation*

The mountd daemon on the server refused the request to mount the file system with an error code NNN. Explanation is an error message returned by mountd.

NFS040F : The specified filesystem is not local to server **hostname**.

You attempted to mount a file system on a server hostname, but the file system is not local to the specified server. If you have been using the server as a timesharing user, you may not have been aware that the file system was remote rather than local. You should find out which system actually hosts the file system (on 4.2BSD systems, use df(1) or examine the file /etc/fstab) and mount it from there.

NFS041F : You have not done a NET USE **printdev**: \\host\printername.

You attempted to print a file on a remote printer using the net print command. However the specified printer had not been redirected with a net use printdev: command. Redirect the printer and reissue the command, or use a print device that has been redirected.

NFS042F : Unable to open file : *DOS error message*

PC-NFS could not open the file to be net printed.

NFS043F : Not enough memory to allocate buffers : *DOS error message*

net print could not allocate internal buffers. This should never happen; if it recurs, contact Sun Microsystems, Inc.

NFS044F : Error writing print data to server : *DOS error message*

An error occurred while copying the file to be net printed to the spool directory on the server.

NFS045F : Remote procedure call to PCNFSD daemon on **hostname** failed.

After copying the file to be net printed to a file in the spool directory on the server hostname, PC-NFS tried to call the pcnfsd daemon on the server to start printing. The call failed. Other preceding error messages may clarify the reason for this. You should check that the pcnfsd daemon is still running on hostname.

NFS046W : Warning: umount: *Reason*

While processing a net use d: /d command, PC-NFS attempted to advise the mountd daemon on the server that the file system was being unmounted. The RPC call failed. This is a warning only: the command is completed locally. However it may indicate a problem with the server.

NFS047F : Incomplete command - needs either \\host\path or a /d switch.

You specified net use x: (where x is a valid drive letter); as it stands, this command is incomplete.

NFS048F : Disk letter must be in the range `d:` to `s:`.

You tried to mount a remote file system on an invalid drive. The first legal drive is D (configuration-dependent); the last is S.

NFS049F : Device **DEV:** is already in use.

You tried to net use a device (printer or drive) that is already in use. Issue net use with no additional arguments to see which devices are in use, and choose a free one.

NFS050F : You can't use **$YPSERVER** when there is no valid YP server.

You used the pseudo-host name $YPSERVER in the net use, but there is no valid Yellow Pages server. (You can check this with the net ypset command.) This is most likely to occur in a Yellow Pages network environment in which the Yellow Pages server was down when you brought up the PC.

NFS051F : The MOUNT table is full : you cannot mount any more drives.

PC-NFS records which file systems are mounted on which drives in a structure called the MOUNT table. This table is presently fixed in size and cannot be changed by the user. If you need to mount a file system, use net use to identify a file system that you are no longer using and dismount it with the net use d: /d command. Then re-issue the original request.

NFS052W : Drive **x:** is not remotely mounted.

You tried to dismount a drive with net use x: /d, but the specified drive was not remotely mounted. Use net use to determine which drives are in use.

NFS053W : Unable to contact the Network Lock Manager on the server.

The net use command included one of the file sharing switches, either /SHARE or /MUSTSHARE. PC-NFS tried to establish contact with the Network Lock Manager on the server but failed. This message will always be followed by a second message, clarifying the outcome of the net use.

NFS054F : /MUSTSHARE was specified: the NET USE has been aborted.

See message #53; since /MUSTSHARE was specified, the file system can only be used if locking is operational; the net use is therefore aborted.

NFS055W : The drive has been mounted, but locking is disabled.

See message #53; since the user specified /SHARE rather than /MUSTSHARE, the net use is allowed to go through, but locking is disabled.

NFS056F : **$HOME** can only be used after you have logged in with NET NAME.

You used the pseudo-path $HOME in a net use, but you have not established a user identity with net name. Note that the default user identity of nobody does not have a home directory.

NFS057F : **$HOME** can only be used if the Yellow Pages are up.

You used the pseudo-path $HOME in a net use, but the Yellow Pages were not active. PC-NFS uses the Yellow Pages to locate your passwd entry and hence your home directory.

NFS058F : Unable to contact Yellow Pages server on **hostname.**

PC-NFS determined that the Yellow Pages were up, and that hostname was supposed to be a valid Yellow Pages server. However when it made a remote procedure call to the ypserv process on the server, the call failed. The ypserv process may have crashed.

NFS059F : There is no password file entry for username **yourname.**

You used the pseudo-path $HOME in a net use, but there is no entry for yourname in the Yellow Pages passwd.byname map. Use ypmatch yourname passwd to check this; if no match is found, ask your network administrator to update the passwd file and remake the Yellow Pages databases.

NFS060F : The password entry for **yourname** is invalid.

You used the pseudo-path $HOME in a net use, but when PC-NFS checked your passwd entry it could not make sense of the "home directory" field. Ask your network administrator to fix the passwd file and remake the Yellow Pages databases.

NFS061F : Unable to open ARP directive file **filename**.

You used the -f option to arp, which tells arp to read a list of directives from a file. However, arp could not open the file.

NFS062F : Invalid line in ARP directive file:

You used the -f option to arp, which tells arp to read a list of directives from a file. While processing the file, an invalid line was found. The offending line is displayed following the error message. Correct the file and reissue the command.

NFS063F : Unable to create ARP entry.

An unexpected error occurred when adding an entry to the ARP table. Check that PC-NFS is installed. If this recurs, contact Sun Microsystems.

NFS064F : Unable to read ARP table from memory.

arp was unable to locate the ARP table. The most likely reason is that PC-NFS is not installed properly. If this is not the problem and the error persists, contact Sun Microsystems.

NFS065F : Invalid Ethernet address '**string**'.

You were using arp to define a mapping from an Ethernet address to a host name. The string you supplied for the Ethernet address was invalid. The address must be given as six hexadecimal numbers separated by colons, e.g. 8:0:20:1:2e:7e.

NFS066F : \nfs\hosts entry for **hostname** conflicts with RARP server.

This problem can only arise in a network environment with Reverse ARP and Yellow Pages at PC-NFS installation time. Although you need not have an \NFS\HOSTS file in this situation, if you do, it must be consistent with the hosts information supplied by the Yellow Pages. This message is followed by additional information about the inconsistency. You should resolve the inconsistency and re-install PC-NFS.

NFS067F : Yellow Pages access error: *Reason*

While trying to access the Yellow Pages, a problem occurred. Reason describes the problem in more detail. This error message will usually be followed by one or more messages from the PC-NFS program that invoked the Yellow Pages service.

NFS068F : Unable to open input file **filename.**

unix2dos or dos2unix was unable to open its input file. Check that the file name is correct.

NFS069F : Unable to open output file **filename.**

unix2dos or dos2unix was unable to open its output file. Check that the file name is correct and that you have write permission for that directory.

NFS070F : Invalid combination of options.

You invoked unix2dos or dos2unix with an inconsistent set of options. You cannot specify both -u (set all characters uppercase) and -l (set all characters lowercase), nor can you specify either -u or -l in conjunction with -b (binary mode).

NFS071F : An error occurred while reading the input file.

unix2dos or dos2unix encountered a file input error.

NFS072F : An error occurred while writing the output file.

unix2dos or dos2unix encountered a file output error.

NFS073I : Stopped at DOS end-of-file.

unix2dos encountered a control-Z character in the input file. Since binary mode was not in effect, it assumes that this is a DOS end-of-file marker, and treats it as such.

NFS074F : Invalid argument **string.**

You specified an invalid argument to ypcat or ypmatch. Check the command syntax against the documentation.

NFS075F : Can't get YP domain name for this machine.

You invoked a PC-NFS utility that tried to perform a Yellow Pages operation. However the utility was unable to determine which Yellow Pages domain this system is in. This should not occur, since the default of noname should be in force.

NFS076F : Can't bind to YP server for domain **domain_name.**

You invoked a PC-NFS utility that tried to perform a Yellow Pages operation. However, the utility was unable to establish contact with the Yellow Pages server process on the current Yellow Pages server system. This error then displays the reason for the failure.

NFS077W : Can't match **key**.

You invoked ypmatch to look up the entry corresponding to key in some Yellow Pages map. The lookup failed. The reason for the failure is given on the next line.

NFS078F : Can't get IP address for my own name (**hostname**).

A PC-NFS Network Library routine tried to determine the Internet address for this PC (named hostname) by looking it up in the Yellow Pages (rather than asking the PC-NFS driver). The lookup failed. Ask your network administrator to make sure that your PC is in the hosts database.

NFS079F : PC-NFS Network Library Error #NN.

An unexpected error occurred in the PC-NFS Network Library. NN is the error code. Further messages may clarify the cause of the problem; if they do not, you should contact Sun Microsystems for assistance.

NFS080F : You cannot include a disk name as part of the destination file-name.

You used the mv command to try to change the NFS name of a file. The syntax for the command is mv [disk:]path1 path2; you cannot specify a disk name as part of the destination file name. You cannot use mv to move a file from one file system to another.

NFS081F : File not found, or access violation.

mv was unable to perform the rename you requested: either the original named file does not exist, or you do not have write permission on the file or directory.

NFS082F : Can't contact portmapper on **hostname**.

You invoked rpcinfo to determine which RPC programs are available on hostname. However rpcinfo was unable to contact the portmapper process (the agent that manages RPC connections) on the server. You should check that hostname identifies a host that is running NFS and RPC.

NFS083I : No remote programs registered.

rpcinfo could not find any RPC programs registered on the specified host. This message is not an error message; however if you believe that the host should be an active RPC or NFS server, you may want to report this occurrence to your network administrator.

NFS102W : **hostname** is not a valid hostname.

An invalid hostname was entered to the telnet "Enter the hostname:" prompt. hostname must exist in file \NFS\HOSTS.

NFS103F : telnet: Connection timed out.

telnet was unable to connect to the specified host in the allotted time. Either the host was busy and was not able to respond, or the host is down.

NFS104F : telnet: Unable to open connection.

telnet was unable to connect to the specified host due to some network error, such as the host telnetd daemon being full.

NFS105F : telnet: cannot change from ethernet connection to a com port.

telnet is already resident using the Ethernet. You must remove telnet if you want to restart it using a communications port.

NFS106F : telnet: cannot change from a com port to an ethernet connection.

telnet is already resident using a communications port. You must remove telnet if you want to restart it using the Ethernet.

NFS107W : Server **servername** is not responding (or mountlist buffer overflow).

You tried to use the showmnt command on a server that was not responding, or the server's mount list is so large that the internal showmnt buffer has overflowed.

NFS108F : telnet: cannot specify command line arguments while telnet is resident.

telnet is already resident, so command line parameters other than hostname are not allowed.

NFS109I : spooling initiated for redirected printer **printername**.

You issued a net print * command. This caused the system to submit all files that had been spooled to the printer queue.

NFS110F : chmod: can't change **file**.

The chmod command failed. This might have occurred, for example, because you do not have ownership to the file, or because you don't have read/write access to the file.

NFS111F : chmod: invalid mode.

You issued the chmod command with incorrect syntax. Refer to the Commands Reference Chapter in the PC-NFS User's Guide for instructions on entering the correct chmod syntax.

NFS112F : **server** is not on the same network as **pc-name.**

You attempted to select a gateway that is not on the local network.

NFS113I : There is **no** YP server currently defined.

PC-NFS does not have the name of a Yellow Pages server (you have not issued the net ypset command), or the Yellow Pages server has been reset as a result of a net ypdomain domain-name command.

NFS114I : No subnet mask has been installed.

You issued a net subnet command to determine the current setting of the Internet subnet mask, but subnet operation has not been enabled.

NFS115I : The subnet mask is **ddd.ddd.ddd.ddd [0xXXXXXXXX]**. Using this mask the network number is **nnn.nnn.nnn.nnn**; the host number is **hhh.hhh.hhh.hhh.**

Either You issued a net subnet command to determine the subnet mask setting, or you successfully used the net subnet * command to obtain the mask from another host on the network. See the section on Internet Addressing in Chapter 7 of this manual.

NFS116W : Unable to obtain the subnet mask from any network server

You tried to obtain the Internet subnet mask from another host on the network using the net subnet * command, but received no reply. Check that your system is connected to the network and that a server or gateway machine is running.

NFS117F : **string** is not a valid controller type.

You specified an invalid controller type. Currently supported Ethernet controllers are 3C501, 3C502, 3C503, 3C523, NI5010, WD8003E, and NIC.

NFS118F : **string** is not a valid I/O port address or shared memory address.

You specified an invalid I/O port address or shared memory address. These addresses are configuration dependent. For specific parameter ranges and default parameters, see the Installing PC-NFS Chapter in this manual..

NFS119F : This command is not supported in this release of PC-NFS.

You tried to issue a net trace command. PC-NFS release 3.0 does not support the net trace command.

NFS120F : net use: x: is joined.

You tried to issue a net use command on a drive which was net joined. You may only use a net use on a unmounted, unjoined drive (letter). Issue a net use command to see what drive letters are in use.

NFS121F : Machine name `host name` is too long.

You tried to issue a net start rdr hostname command where host name has more than 15 characters.

NFS122F : Unable to delete host (ip addr) from ARP table.

PC-NFS is not able to delete host specified in arp -d host command from the arp table. Run ARP -d to verify that host is in the ARP table and that you spelled the name correctly.

NFS123F : Unable to empty ARP Table.

ARP -d * cannot empty ARP table. Try again. If that does not work, reboot and try again.

`install` Error Messages

The following error messages can occur while running the PC-NFS `install` program, or in the "Connections" section of the `nfsconf` program:

NFS124W : The DMA channel is not within the valid range of answers. Consult the PC-NFS User's Guide or the Help Screen to find the list of acceptable DMA channels.

NFS125W : The transceiver value must be a 1 or 2.

1 for thin cable (onboard transceiver)
2 for thick cable (external transceiver)

NFS126W : The I/O address base is not within the valid range of answers. Consult the PC-NFS User's Guide or the Help Screen to find the list of acceptable values.

NFS127W : The interrupt level is not within the valid range of answers. Consult the PC-NFS User's Guide or the Help Screen to find the list of acceptable interrupt levels.

NFS128W : The shared memory address is not within the valid range of answers, or is not on the appropriate byte boundary. Consult the PC-NFS User's Guide or the Help Screen to find the list of acceptable values.

NFS129W : PC-NFS Serial Line Internet Protocol can only operate with COM1 or COM2. Valid answers are therefore only 1 and 2.

NFS130W : PC-NFS Serial Line Internet Protocol can only operate at speeds of 1200, 2400, 4800 and 9600 baud.

NFS131W : Valid drives are A through S, drives T through Z are reserved by PC-NFS. You must choose a drive that is different from the one which you are currently running the INSTALL from.

NFS132W : The only acceptable answers for this field is Y (yes) or N (no). Consult the help screen for more information.

NFS133F : Unable to find the help file on the current drive. You must make the Basic PC-NFS Diskette the current drive before running INSTALL.

NFS134F : A complete copy of PCNFS.SYS with a serial number cannot be found. This file must exist in order for the installation to take place.

NFS135F : Your upgrade kit is not sufficient. Your installed version is either too old, or it does not have a serial number. Please contact Sun Microsystems.

NFS136F : Your current version of PCNFS.SYS cannot be accessed without generating an I/O error. Please correct the problem and re-run the installation program.

NFS137F : You do not have either a C:\NFS directory or a C:\NFS\HOSTS file present. This indicates that you do not currently have a version of PC-NFS installed. This installation program is for upgrades to current versions of PC-NFS only.

NFS138F : Unable to define the help key.

NFS139F : Unable to create a temporary file. Please check your disk.

NFS141F : Memory Allocation Error

NFS142F : Can't read the PC-NFS Diskette.

NFS143F : The target drive doesn't have enough free space.

NFS144F : Can't open the PC-NFS Diskette.

NFS145F : Can't open PCNFS.SYS on the target drive.

NFS146F : Can't find the serial number in PCNFS.SYS

NFS147F : Can't read PCNFS.SYS on the target drive.

NFS148F : Can't create NFS files on the target drive.

NFS149F : Rename failed. Please check your target disk.

NFS150W : Can't find your ANSI.SYS. Please edit your CONFIG.SYS after completing the install to provide the correct path to ANSI.SYS.

`nfsconf` Error Messages

The following error messages can occur while running the `nfsconf` program:

NFS151F : Can't find help file on the current drive.

NFS152F : Warning: mount: cannot do local bind.

NFS153F : Can't define help key.

NFS154F : Rename failed. Please check your disk.

NFS155F : Internal error -- get nfs info failed.

NFS156F : PC-NFS Version mismatch.

NFS157F : No Print Redirector present, unable to initialize printer configuration. Run PRT *.

NFS158F : Cannot find NFS device.

NFS159F : NFS installation error.

NFS160F : net: install internal error -- get nfs info failed

NFS161W : You entered an unrecognized command key. The command keys (accelerators) are shown on the right of each menu option. No other commands are valid.

NFS162F : Unable to set the home key.

NFS163F : No help available.

NFS164F : Out of memory.

NFS165F : Copy operation failed on you database files. Please check your disk.

NFS166F : Unable to open your database files. Please check your disk.

NFS167F : Rename failed. Please check your disk.

NFS168W : Can't Create new hosts database file. Please check your disk.

NFS169W : You need to specify your PC's name.

NFS170W : You need to specify your PC's Internet address.

NFS171W : You entered an illegal host name.

NFS172W : You entered an illegal Internet address. The format is:

a.b.c.d
a.b.c
a.b
a

where a four part address specifies a type C Internet address, a three part address specifies a type B Internet address, a two part address specifies a type A Internet address and a one part address will be stored directly as the network address.

NFS173W : You entered an illegal subnet mask. The format is:
N[NN].N[NN].N[NN].N[NN]
where N is any decimal digit (0 through 9).

NFS174W : If you wish to use Yellow Pages, you must enter a Yellow Pages domain name.

NFS175W : You may not leave any field blank. Press the Esc key to get rid of this message, then correct any invalid items.

NFS176W : The profile data in the SLIPCONF.DB data base is incorrect. This should not happen unless you edit the file using a regular text editor. Examine the file and check it against the information in the Technical Reference section.

NFS177W : There are no resources defined in the resource pool, so you cannot modify or delete resources at this time. Resource definitions are created as part of the Mount process: select Mount from the Resources menu, pick the drive or printer on which the new resource is to be mounted and then select New Disk (or New Printer). You can then define the resource, which will subsequently be recorded in the resource pool.

NFS178W : Unable to find an executable copy of the PC-NFS LifeLine Configuration program LLCONF in your search path. Re-install PC-NFS LifeLine from the distribution diskettes and try again.

PC-NFS LifeLine is a package which provides two valuable applications to the PC-NFS user: electronic mail, and network backup. If you do not have a copy of PC-NFS LifeLine, you may order one from your Sun sales representative or from the Sun Telemarketing group. The phone number is in your PC-NFS documentation.

NFS179W : There is not enough free memory to run the PC-NFS LifeLine Configuration program LLCONF. Either remove some of the resident programs from your system, or run LLCONF standalone (i.e. exit from NFSCONF and type LLCONF at the DOS prompt).

NFS180W : Connections configuration is performed by PCNFSCFG. An executable copy of PCNFSCFG cannot be found in your search path. Check your path to make sure it includes the directory containing PCNFSCFG (normally the NFS directory containing the other PC-NFS executables).

NFS190W : There is not enough free memory to run the connection configuration program PCNFSCFG. Either remove some of the resident programs from your system, or run PCNFSCFG standalone with the -a (adapter configuration) option. Exit from NFSCONF and type PCNFSCFG -A at the DOS prompt.

Glossary

B

Address Resolution Protocol (ARP)
This protocol provides translation of host addresses from Internet addresses to Ethernet addresses.

`ANSI.SYS` driver
This device driver is distributed with the DOS operating system. `ANSI.SYS` must be installed in a PC's system directory so that PC-NFS can properly format screen displays.

application
A computer program that performs a task previously done by another means. Word processing programs, spreadsheet programs, and database programs are examples of applications.

ASCII (American Standard Code for Information Interchange)
A standard code for the representation of alphanumeric information.

authentication
A means to distinguish individual system or network users and to assign these users different privileges.

Authentication server
A machine on the network that has software which authenticates user privileges on the network. For PC-NFS this software is `pcnfsd`.

`AUTOEXEC.BAT` file
This DOS system file can exist on any PC. `AUTOEXEC.BAT` contains a series of command lines that execute when the computer starts up. These commands typically define the operating system environment. This is where the commands go that start up PC-NFS and that set the appropriate parameters for your network environment.

backup
The process of making copies of files, archiving, as protection against the destruction or loss of the original files.

buffer
A temporary storage area in RAM, used typically to hold data being transferred to or from a device.

cache
A section of RAM set aside to hold data that is accessed frequently.

client
A computer that uses resources provided by another machine on the network. Most commonly, these resources are disk storage space and printers. A PC running PC-NFS becomes a client of the network it joins. (See also **server**.)

communications board
A hardware board installed in a PC that provides the Ethernet connection required to run PC-NFS.

compatibility mode
This file sharing mode provides *Deny Write* access if you want to read a file, and *Deny All* (exclusive) access otherwise. By default, DOS opens files in this mode.

`CONFIG.SYS` file
This DOS system file can exist on any PC. `CONFIG.SYS` defines which device drivers to install.

copy protection scheme
A means by which software vendors discourage or prevent users from illegally copying licensed software. PC-NFS itself implements a scheme that detects and publicizes the use of illegal PC-NFS serial numbers.

daemon
A service program that runs continuously on a server system in a UNIX environment. A daemon program generally provides some service or resource to client systems on the network. On Sun systems, daemon programs have a `d` at the end of their program names.

default
For commands that require user input, there is often a value supplied by the program if the user does not enter a value. The value supplied by the program is the default.

directory tree
In the DOS operating system, files are organized in directories. A directory can contain other directories, called subdirectories which also can contain files and directories. This hierarchical structure of directories forms a directory tree.

domain
A named collection of machines on a network.

Ethernet
A type of network that supports high speed communications between machines. The network usually uses coaxial cables.

Ethernet Address
A six-part hexadecimal number in which a colon separates each part (for example, 8:0:20:1:2f:0). This number identifies the Ethernet communications board installed in a PC, and is used to identify the PC as a member of the network.

export
To make a file system available so that one or more other systems can access (mount) it. On Sun servers, this is done by adding an entry in the `/etc/exports` file on the appropriate server system. (See also **mount**, **server**, and **client**.)

file access
The facility that allows a user to work with a remote file as if the file were local. File access differs from file transfer in that it does not create a local copy of the file. (See also **file transfer**.)

file attributes
The qualities that describe a file and the ways in which it can be accessed and used. File attributes include among others, file names, file permissions, and user classes.

file format
The way in which data is represented in a file. This representation varies among different operating systems. When you work with PC-NFS, you can use the `dos2unix` and `unix2dos` programs to convert a DOS file to UNIX format and vice versa.

file locking
A service to prevent simultaneous updates of the same file by different users. PC-NFS supports advisory file locking, which allows you to maintain a consistent database if you enforce advisory file locking for all of your client systems. PC-NFS does not support mandatory file locking, in which the system verifies every file access.

file name mapping
A PC-NFS service by which NFS (UNIX) file names are translated into legal DOS file names. These mapped file names are also converted back to their original NFS forms when necessary.

file permissions
These permissions refer to the three types of file access: read, write, and execute. As the owner of a file, you can grant all or some of these file permissions to user groups.

file system
The organizational structure, composed of directories, subdirectories and files, that an operating system uses to manage data.

file transfer
Copying a file from one computer to another. File transfer differs from file access in that it creates a *second copy* of the file. (See also **file access**.)

FTP (File Transfer Protocol)
A TCP service that transfers files between systems on a network, without regard to the operating systems of the machines involved in the transfer.

gateway system
A system that provides a link between two networks.

group id (gid)
A unique number associated with each group name on a server system. The system assigns your group id to any files that you create.

home directory
A user's default location within an NFS server's file system.

host
The name a network uses to identify a machine on the network.

host name
A unique name that identifies each host machine on the network. You need a database named `\NFS\HOSTS` on networks without a Yellow Pages server. When this database is present, it contains the unique host names and Internet Protocol (IP) addresses of your PC and, sometimes, NFS servers.

hot-key
A set of keystrokes that allows you to reduce routine procedures to a short sequence. The `nfsconf` program allows you to define a hot-key sequence to send data to a printer. The `telnet` hot-key allows you move easily between your DOS environment and a session on a remote host system.

`inetd` daemon
A service program that runs continuously on a server system in a UNIX environment to invoke connection oriented services.

`install` program
A program that resides on your first PC-NFS distribution diskette that constructs the files necessary for you to run PC-NFS successfully.

Internet Protocols
Computer communication protocols developed by the United States Department of Defense for the scientific and technical fields. They include TCP/IP, TELNET, and FTP.

Internet (IP) Address
A number that uniquely identifies every computer connected to a TCP/IP network.

join
A command to connect a drive to a directory on another drive. The DOS `JOIN` command does not work with NFS files, but `net join` allows you to join one mounted file system to a subdirectory of another.

local
In a network, files, devices, or users that are on your machine.

Locking Services
SUN server software that enables you to protect files from unwanted access.

log in
To gain access to a computer's operating system. This can be accomplished by (1) simply turning on the computer, or (2) completing a clearance procedure such as entering a user name and password.

memory resident
Programs or data loaded into memory, but not saved when the machine is rebooted.

mount
To make a file system on a server available to your PC.

name cache
A list of the last 64 file name mappings created by PC-NFS in converting NFS file names to DOS file names.

`net` program
The PC-NFS program that implements the various network management functions.

Network File System (NFS)
A facility that allows you to share files in a heterogeneous environment of machines, operating systems, and networks.

`nfsconf` program
A program that allows you to configure the operation of PC-NFS.

\NFS\HOSTS file
A file that contains the host name and Internet Protocol (IP) address of your PC, and sometimes, the addresses of NFS servers. You need this file on networks that do not have Yellow Pages or Reverse ARP.

nobody
If you do not specify a user name, the system assigns you this default name. `nobody` is associated with a set of minimum system privileges defined by your system administrator.

noname
The Sun default name for a Yellow Pages domain.

operating system
A collection of programs that monitors the use of the machine and supervises the other programs executed by the machine.

path name
A statement that identifies the position of a file or directory within the tree structure of a file system.

PostScript™
A page description language developed by Adobe Systems, Inc. used by a wide range of output devices.

protocol
A set of conventions that govern how machines within a particular network communicate with each other.

RAM
Random Access Memory.

remote
In a network, files, devices, and users not attached to your machine.

remote access
The ability to read and write remote files.

Remote Procedure Call (RPC)
A mechanism that lets a program running on a client machine call a procedure that a remote server executes.

restore
The process of putting backed up files back on a storage device.

Reverse ARP (RARP)
Reverse Address Resolution Protocol allows a machine which is connected to an Ethernet to determine its IP address.

server
A machine that provides resources to other computers on a network. Two examples of servers are: (1) file servers, which provide physical disk storage space, and (2) print servers, which make their attached printers available to other systems. (See also **client**.)

session
A time period defined by the beginning of a program and its termination. A PC-NFS session begins when PC-NFS starts and ends or when the system is shut off or rebooted.

spool
The mechanism that forms a queue of files for a shared resource so that they use the device in an orderly fashion.

subnet
A means of making the Ethernet addresses for small networks more efficient by splitting host numbers into two fields.

subnet mask
The method used to separate the two parts of the host name in a subnet.

SunOS
The operating system, a version of UNIX, that runs on Sun workstations.

superuser
A special type of system user who can change any other user's file attributes.

system administrator
The person responsible for managing systems on a network, including NFS server systems. The system administrator's responsibilities include updating network databases for new systems and installing network software such as the `pcnfsd` program.

TCP/IP
Transmission Control Protocol/Internet Protocol.

telnet
A protocol for establishing a login session on another computer.

terminal emulator
A program that causes a PC screen and keyboard to act like a video display terminal attached to another computer.

time-out
A pre-defined period of system inactivity, during which the system waits for user or network response. If there is no response before the end of the time-out, the system takes some action.

UNIX
An operating system initially developed by AT&T which is now available from many sources.

user classes
Categories of users used to enforce file protection. The three user classes are *owner*, *group*, and *other*. You can assign file permissions to each user class for each file.

user id
A unique number associated with each user name on a server system. The system assigns your user id to any files that you create.

user name
The character string with which you identify yourself to the system, usually assigned by your system administrator.

VMS
The operating system that runs on Digital Equipment Corporation's VAX family of machines.

Yellow Pages service
The YP services provide access to a set of network databases. The databases contain such information as host names, Internet addresses, and Ethernet addresses. A host machine that provides YP databases is called a YP server.

Diskette-Only Installation For 3C505

C

This appendix contains instructions for making diskette-only installations of PC-NFS if you are using the 3Com 3C505 board. Chapter 3, "Tailoring Your System", contains more information about the files referenced in this Appendix.

3C505 Installation

Basic Requirements

The 3Com 3C505 board requires two diskette drives to install and run PC-NFS on a diskette only system. If you do not have two diskette drives, you cannot run PC-NFS.

In the instructions that follow, DOS drive `A` is the boot drive and DOS drive `B` is the second diskette drive.

The next section describes how to make the PC-NFS 3C505 Boot diskette. The section after that describes how to make the PC-NFS Drivers diskette for the 3C505.

Formatting Diskettes

To begin, place your DOS boot diskette in drive `A` and a new diskette in drive `B`. To create a bootable diskette, enter:

```
A>FORMAT B: /s
```

This creates a bootable diskette. Label this diskette, "3C505 Boot." Replace the 3C505 Boot diskette in drive `B` with another new diskette. To format this diskette for the PC-NFS Drivers diskette, enter:

```
A>FORMAT B:
```

Label this diskette, "PC-NFS Drivers." Remove this diskette and set it aside.

Copying CONFIG.SYS

Place the 3C505 Boot diskette in drive B. If you have a CONFIG.SYS file on your DOS Boot diskette, copy it to the 3C505 Boot diskette. Enter:

```
A>COPY CONFIG.SYS B:
```

Edit the CONFIG.SYS on the 3c505 Boot diskette so it contains the lines below.

If you do not have a CONFIG.SYS file, enter:

```
B:
COPY CON CONFIG.SYS
FILES=20
BUFFERS=20
DEVICE=B:\ANSI.SYS
DEVICE=B:\NFS\PCNFS.SYS
DEVICE=B:\NFS\SOCKDRV.SYS
DEVICE=B:\DRIVERS\PSH.SYS
DEVICE=B:\NFS\3C505.SYS
LASTDRIVE=V
^Z
A:
```

The last ^Z means to press Ctrl Z and then Enter, which saves the file.

Creating an AUTOEXEC.BAT

If you have an AUTOEXEC.BAT file on your DOS Boot diskette, copy it to the 3C505 Boot diskette. Enter:

```
A>COPY AUTOEXEC.BAT B:
```

Edit the AUTOEXEC.BAT on the 3C505 Boot diskette so it contains the lines below.

If you do not have an AUTOEXEC.BAT file, enter:

```
B:
COPY CON AUTOEXEC.BAT
SET TZ=EST5EDT
PATH=A:\;A:\NFS
B:\LDR
SET NFSDRIVE=A
PRT *
NFSRUN
^Z
A:
```

Copying Files to the Boot Diskette

Make an NFS directory on the 3C505 Boot diskette:

```
MD B:\NFS
```

Remove the DOS diskette from drive A. Place the PC-NFS Installation diskette in drive A. Enter:

```
COPY PRT.EXE B:\NFS
COPY NET.EXE B:\NFS
```

Remove the PC-NFS Installation diskette from drive A. Place the PC-NFS Connections diskette in drive A. Enter:

```
COPY EM_MSG.TXT B:\NFS
COPY NFSRUN.EXE B:\NFS
COPY LDR.CFG B:\
```

Remove the PC-NFS Connections diskette from drive A. Place the PC-NFS Configuration diskette in drive A. Enter:

```
COPY NFSCONF.TXT B:\NFS
COPY NFSCONF.NDX B:\NFS
COPY ETHERS B:\NFS
COPY NETGROUP B:\NFS
COPY NETWORKS B:\NFS
COPY PASSWD B:\NFS
COPY PROTOS B:\NFS
COPY RPC B:\NFS
COPY SERVICES B:\NFS
COPY GROUPS B:\NFS
COPY PCNFS.MSG B:\NFS
```

The LDR.CFG file is a text file. It contains references to drive C. Edit the file, changing all references to drive C to refer to drive B.

This completes the process of creating the PC-NFS 3C505 Boot diskette.

Copying Files to the PC-NFS Drivers Diskette

Place the PC-NFS Drivers diskette into drive B. This diskette must also contain the `ANSI.SYS` file. To copy `ANSI.SYS` to the Boot diskette, place your DOS boot diskette into drive `A`, enter:

```
COPY ANSI.SYS B:
```

To make the `NFS` and `DRIVERS` directory on the PC-NFS Drivers diskette, enter:

```
B:
MD \NFS
MD \DRIVERS
```

Place the PC-NFS Installation diskette into drive `A`. Enter:

```
A:
CD \NFS
COPY PCNFS.SYS B:
```

Remove the PC-NFS Installation diskette from drive `A`. Place the PC-NFS Connections diskette into drive `A`. Enter:

```
COPY SOCKDRV.SYS B:
COPY 3C505.SYS B:
COPY 3C505DX.SYS B:

CD B:\DRIVERS
COPY PSH.SYS B:
COPY PROA.SYS B:
COPY VECIE3.SYS B:
CD B:\
COPY LDR.EXE B:
```

This completes the creation of the PC-NFS Drivers diskette. Remove both diskettes from the diskette drives.

Starting PC-NFS

To start PC-NFS, place the 3C505 Boot diskette into diskette drive `A`. Place the PC-NFS Drivers diskette into drive `B`. Reboot the PC by pressing the Ctrl, Alt, and Del keys simultaneously.

Turn to Chapter 2, "Configuring PC-NFS," to continue.

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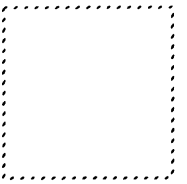
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PC-NFS 3.0.1 Change Pages

Installing PC-NFS
A Guide to the User and System Administrator

Part No. 814-1031-02

Instructions

1. If you are upgrading from PC-NFS 3.0 to 3.0.1, take the Read This First document out of your documentation binder and replace it with the 3.0.1 Release Notes.

   If you are upgrading from 1.0 or 2.0, your new documentation does not include a copy of the Read This First document. In this case, place the 3.0.1 Release Notes in the front of the binder.

2. Use the following instructions to replace pages in Installing PC-NFS, A Guide to the User and System Administrator.

Take out pages	Insert pages
iii-viii	iii-viii
9-14	9-14
19-28	19-28
37-42	37-42b
57-62	57-62
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119-120	119-120
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-	150a-150d, behind the tab labeled "Diskette Installation"

   You may want to file this instruction sheet at the back of your binder to keep a record of the changes.

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Installing PC-NFS

1

Before you install PC-NFS on your PC there are several steps that you must complete. The sections that follow explain the entire procedure outlined below in detail.

1. Make sure that your hardware and software environments match the requirements for PC-NFS.
2. Install the Ethernet communications board or connect the serial port in the PC, and attach the PC to the network.
3. If you are using Ethernet, determine the Ethernet address of your PC's communications board. If you are using serial, determine the COM port and baud rate.
4. Take your Configuration Form, located just before this chapter, to your system administrator. If you are using Ethernet, make sure you fill in your Ethernet Address before giving the form to your system administrator.
5. Make sure that any network software already on your PC will coexist with PC-NFS.
6. Back up your PC-NFS distribution diskettes.
7. Obtain the completed Configuration Form from your system administrator and install PC-NFS.

Hardware and Software Requirements

This section describes the minimum hardware and software you need to install and run PC-NFS.

Hardware Requirements:

- One IBM PC™, XT™, PC AT®, PS/2™, or 100% IBM® PC-compatible personal computer, such as COMPAQ®, COMPAQ Deskpro®, COMPAQ Portable 286®, or Leading Edge® or a SunIPC.
- At least 512 Kbytes of usable RAM. PC-NFS uses approximately 80 to 90 Kbytes. The PC resident program `prt.exe` (used for remote printing) requires approximately 4.5 Kbytes. The remaining RAM is generally available for your programs, although PC-NFS does occasionally use additional memory to execute certain utilities.
- If you plan to install a copy of PC-NFS on a hard disk for the first time, you need at least 950 Kbytes of free space. If you are upgrading to a new release of PC-NFS, you need only an additional 200 Kbytes of free space.
- One double-sided, double-density diskette drive.
- Ethernet board or serial port:
  For the Ethernet connection you need:
  - One Ethernet communications board. Options include:
    - 3Com® 3C501, 3C503, 3C505, 3C523
    - Ungermann-Bass NIC, NIU
    - Western Digital WD8003E
    - MICOM-Interlan® NI5010
  - One thin Ethernet T-tap or one standard Ethernet transceiver and cable

  A serial port requires an RS232C cable on your `COM` port or a Hayes compatible modem.

Software Requirements:

- IBM's PC-DOS 3.0 or higher, *or* a compatible version based on Microsoft's MS-DOS 3.0.
- One or more Sun-2 or higher servers running SunOS™ Version 2 or higher, *or* one or more other servers that support NFS.

If you know your Ethernet address, your communications board is installed, and you need no further information, or if you are upgrading from a previous release of PC-NFS, proceed to the section, "Installing PC-NFS," in this chapter.

Installing the Communications Board

PC-NFS requires an Ethernet communications board or serial board installed in your system. The supported network boards are:

- 3C501 3Com Etherlink
- 3C503 3Com Etherlink II
- 3C505 3Com Etherlink Plus
- 3C523 3Com Microchannel
- NIC Ungermann-Bass
- NIU Ungermann-Bass
- NI5010 Micom-Interlan
- WD8003E Western Digital

The possible serial links are:

- Serial (dial-up) - requires a Hayes compatible modem
- Serial (direct)

If your PC does not have a communications board or serial card installed, you must be install one before you can install the PC-NFS software.

Note that communications boards are extremely static sensitive. Follow the installation instructions that come with the board or have someone who is familiar with the board install it for you.

If you are using a serial port to connect to the network, proceed to the section, "Network Coexistence."

Once the communications board is installed, you must obtain its Ethernet address, as explained in the next section. Also, if the communications board was originally installed to run software other than PC-NFS, you must make sure that the software can coexist with PC-NFS. The section, "Network Coexistence," in this chapter explains how to check for conflicts.

Determining the Ethernet Address

Every Ethernet board comes from the manufacturer with a unique *Ethernet address*. An Ethernet address is a six-part hexadecimal number in which a colon (:) separates each part. For example:

```
8:0:20:1:2f:0
```

Note that the address *cannot* be 0:0:0:0:0:0 or ff:ff:ff:ff:ff:ff.

You need to supply this address to your system administrator on the Configuration Form that appears before Chapter 1. The system administrator may need to enter this address in a network database. The PC-NFS distribution diskettes contain a program, `myeaddr` that finds the Ethernet address for you.

Most communication boards have either an I/O port address or a shared memory address. Following the procedures below, you must determine the communications board I/O port address or shared memory address to determine its Ethernet address. If a supported board does not have these parameters, you can still use the program to find its Ethernet address.

If the communications board is not installed, install it before proceeding.

Default Settings

First, find out whether the network board was installed with factory settings (the default), or whether it was reconfigured to use a different I/O port address or shared memory address. If you don't know, assume the default factory settings. If it was reconfigured, turn to the next section, "Reconfigured Settings," to determine your Ethernet address.

Some boards, such as the Ungermann-Bass NIU and the 3Com 3C523 work with the `myeaddr` program as described below even when they do not have the factory settings. For these boards you do not have to consult the "Reconfigured Settings" section.

To run the `myeaddr` program, place the PC-NFS Configuration distribution diskette in drive `A` and type:

```
C>A:myeaddr <board_type>
```

where *board_type* is one of the communication boards listed under "Hardware Requirements," earlier in this chapter.

For instance, for a 3C501 board, enter:

```
C>A:myeaddr 3C501
```

The system displays the Ethernet address in the following format:

```
Your 3C501 Ethernet address is xx:xx:xx:xx:xx:xx
```

Enter this number on your Configuration Form and proceed to the section, "Network Coexistence."

Reconfigured Settings

If your board is not set to the factory settings, it is reconfigured. You can still use the `myeaddr` program to determine the board's Ethernet address, but you must enter information in addition to the board type.

The columns in Table 1-1 identify the boards that have an I/O Port Address, a Shared Memory Address, or Neither. The Neither boards do not require a parameter for `myeaddr` to determine the Ethernet address.

Table 1-1 *Table of Board's Parameters*

I/O Port Address	Shared Memory Address	Neither
3C501 3C503 3C505 NI5010 WD8003E	NIC	NIU 3C523

There is no software method to find the I/O port address or the shared memory address. You must get the address from the person who changed the factory settings. You can consult Tables 1-2 and 1-3 on page 19 to find acceptable ranges for these values. Table 1-3 also contains the interrupt number which you need.

Once you have the correct address, run the `myeaddr` program. To run the program place the PC-NFS distribution Configuration diskette in drive `A` and type:

```
C>A:myeaddr <board_type> <ioport_addr | shmem_addr> <int#>
```

Always enter board_type (3C501, 3C503, 3C505, NIC, NIU, 3C523, NI5010, or WD8003E), the I/O *port address* or *shared memory address* for the board, and the *interrupt number* the board is configured for (if it was changed). For instance, for a NIC board, enter:

```
C>A:myeaddr 3C505 D000H
```

The program displays the Ethernet address in the form:

```
Your NIC D000H Ethernet address is x:xx:xx:xx:xx:xx
```

Enter your Ethernet address on the PC-NFS Configuration Form and deliver the form to your system administrator.

Network Coexistence

There are a number of networks that run on personal computers. PC-NFS can coexist these four:

1. Ungermann-Bass Net/One, release 16
2. IBM PC Network
3. 3Com 3+
4. TOPS

The Net/One program must run on a NIU board in order for PC-NFS to run on a NIU board. If they run concurrently, you must start the Net/One network first since PC-NFS uses some Net/One software. PC-NFS coexists with Net/One clients or workstations only. You cannot run PC-NFS on a Net/One server.

You must use the `on` option of the `net pcnet` command to run the IBM PC-Network simultaneously with PC-NFS. For details on the usage of the `net pcnet` command see Chapter 8, "Commands Reference" in the *PC-NFS User's Manual.*

PC-NFS and 3Com 3+ run concurrently only using the following boards: 3C503, 3C505, and 3C523. You must use PC-NFS version 3 and 3Com 3+, with the 3Com 3+ program installed first. 3Com 3+ must also be started before PC-NFS when running the networks simultaneously.

To use TOPS with PC-NFS, you must edit the `TOPSKRNL` file which is in the TOPS directory. This file overrides the default setup for TOPS. The file format for the `TOPSKRNL` file appears in an appendix of the TOPS manual. This file contains the following two lines:

```
Last logical Drive (C - Z):J
Last logical Drive (C - Z):S
```

Replace these lines with the two lines similar to the following:

```
FFHUUUUUUU
FFHHHHHHHHUUUUUUUUUU
```

Each `F` stands for a diskette drive, a local hard disk drive, and each `U` as an unused drive available for TOPS. The configuration above permits PC-NFS mounted drives on DOS drives `D - J` and TOPS drives on DOS drives `K - S`. You can enter the `H`'s and `U`'s in any order that you wish, although you cannot use drives `T`, `U` , and `V`. You must start the TOPS network before the PC-NFS program to run the two concurrently.

The default settings for these parameters are as follows:

Table 1-2 *Communications Network Board Default Parameters*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	3	300	----
3C503	3	300	----
3C505	3	300	----
NI5010	3	300	----
NIC	2		D000H
WD8003E	2	280	D000H

The following chart shows the acceptable ranges for these parameters:

Table 1-3 *Communications Network Board Parameter Ranges*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	2-7	200H-3F0H	----
3C503	2-5	250H-350H	----
3C505	3-7,9 (PC) 3-7,9-12,14,15 (AT)	200H-3F0H	----
NI5010	3 or 5	200H-3E0H	----
NIC	2-7	----	8000H-F800H (512K) - (992K)
WD8003E	2-7	200H-3E0H	8000H-F800H

In some cases the PC-NFS installation program asks you for a DMA Channel and Transceiver Type. Use the following table to help you determine these values. The transceiver values are thick and thin. The program accepts numeric values for this parameter, 1 for thin, 2 for thick. If you are unsure, use the default value for both parameters.

Table 1-4 *DMA Values and Transceiver Types*

Board	DMA Values	Default DMA Value	Default Transceiver Type
3C503	1, 2, 3	1	thin
3C505	0, 1, 3 (AT 8 bit) 5-7 (AT 16 bit)	1	

If you do not know how to answer any questions about your network connections, ask your system administrator for help.

Serial Installation. If you chose serial, the program asks whether you are directly connected or dialing up the server. Select either `direct` or `dial-up` as appropriate. The PC-NFS installation program then asks you for the communications port to be used (`COM1` or `COM2`) and for the baud rate (1200, 2400, 4800, or 9600).

Loading the Distribution Diskettes

Before beginning the actual installation, the PC-NFS installation program allows you to go back and change any of your responses. When you're ready to begin the actual installation, press Enter.

The PC-NFS installation program asks you to load the installation diskettes. When you have successfully loaded the installation diskettes, the PC-NFS installation program asks you if you are ready to continue. If you are, it starts the `nfsconf` program. If you are not ready to continue, press Esc to exit to DOS. If you do exit to DOS, however, note that your environment is in an inconsistent state, and you should run `nfsconf` and then reboot as soon as possible.

For the next step in the installation process, proceed to Chapter 2, "Configuring PC-NFS."

Diskette-Only Upgrade Installation

You must follow the steps below to prepare a diskette. If you do not follow these steps, you will get a "disk out of space" error message when you attempt to install PC-NFS.

1. Make a formatted bootable diskette following the procedures in the next section.
2. Copy these files from your present PC-NFS diskette to the newly formatted diskette.
   - `CONFIG.SYS`
   - `ANSI.SYS`
   - `COMMAND.COM`
   - `AUTOEXEC.BAT`
   - `\NFS\PCNFS.SYS`
   - `\NFS\HOSTS`

Your installation procedure differs slightly from a first-time installation since you have a previous version of PC-NFS on your system. You will see an additional screen after the copyright screen, asking:

```
Do you wish to do an upgrade (y/n)?
```

Your previously installed PC-NFS has a unique serial number. If you answer **Y** to this prompt you will retain your old serial number. If you answer **N**, you will get a new serial number when you install the upgrade.

The PC-NFS installation program uses the values from your current configuration as the default values. Pressing Enter for each of the questions in the installation process keeps your original configuration.

The rest of the procedure is identical to a first-time installation with the following exception. After you load all the diskettes, you do not have to configure PC-NFS, it uses your old configuration. You should reboot, to bring up the new version of PC-NFS. If you want to reconfigure any part of the program or mount new network disk or network printers, run the `nfsconf` program after you reboot. Follow the directions in the next section to install your upgrade.

Diskette-Only First Time Installation

If you are installing PC-NFS on a diskette-only system, you need to prepare a bootable DOS diskette before you run the PC-NFS installation program. Use the following procedure to create a bootable diskette:

```
A>FORMAT B: /s
Insert new diskette for drive B:
and strike ENTER when ready

Formatting...Format complete
System transferred

362496 bytes total disk space
 40960 bytes used by system
321536 bytes available on disk
```

If you are using a NIU board from Ungermann-Bass or a 3Com 3C505 board, you must make the PC-NFS disk by hand following the instructions in Appendix C of this book. You must also have a minimum of two diskette drives in your system.

Installing ANSI.SYS

The PC-NFS utilities all use ANSI control codes to format their screen displays. For this to work, you must have a copy of the `ANSI.SYS` device driver (distributed with your PC-DOS or MS-DOS system) installed in your root directory. This is why you should copy `ANSI.SYS` from the DOS distribution diskette to the root directory of the disk or target diskette.

Additional Files

If you are installing PC-NFS on a diskette-only system, you do not have room to load all of the software that PC-NFS provides. The PC-NFS installation program loads the basic PC-NFS software onto your diskette. You can use the additional software by loading the PC-NFS Utility diskette into your second drive, and specifying the drive when you run the utility. You can also put the additional software on a remote file system and access it there. For more information about executing PC-NFS utilities from a remote file system, see Chapter 3, *Tailoring Your System.*

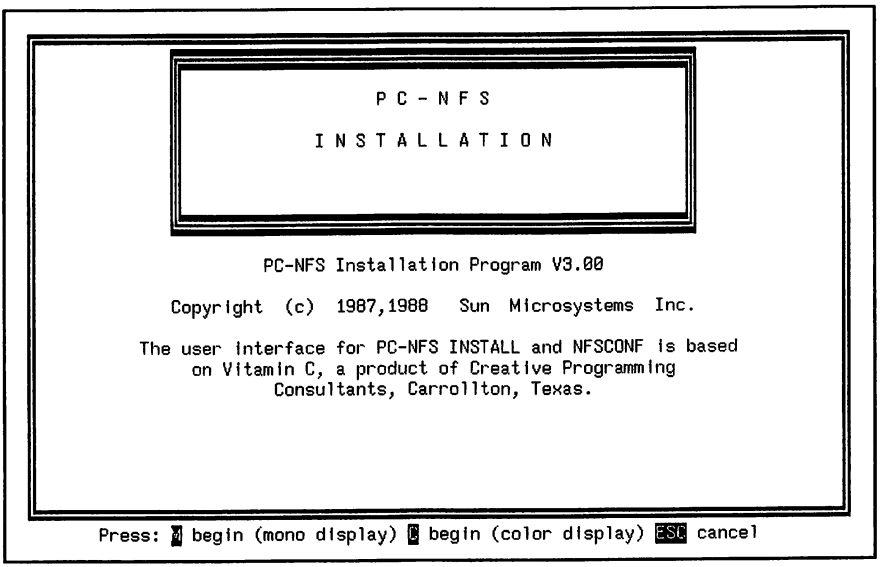
PC-NFS Installation

To begin the PC-NFS installation:

1. Insert the first PC-NFS installation diskette into your diskette drive.
2. At the DOS prompt, >, type:

   >A:

   where A is the drive the diskette is in.
3. Type **install** and press Enter. The copyright screen displays:



   You must select either M for a monochrome display or C for a color display to continue. There is no default value. If you want to quit the installation, press Esc.

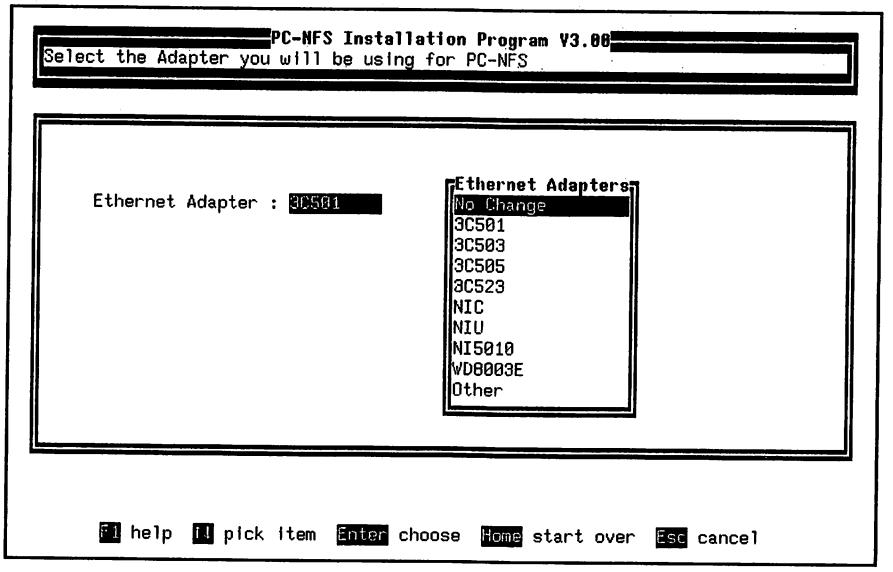
The PC-NFS installation program begins by asking you where you want to install PC-NFS. Enter the letter of the drive where you want to install PC-NFS. Note that you can not install onto the same drive from which you are running the installation program. For example, if you are installing from drive A, you can not install PC-NFS onto drive A.

As you answer the questions in the PC-NFS installation and configuration programs, remember that you can press F1 for help at any time up to the point where you start copying diskettes.

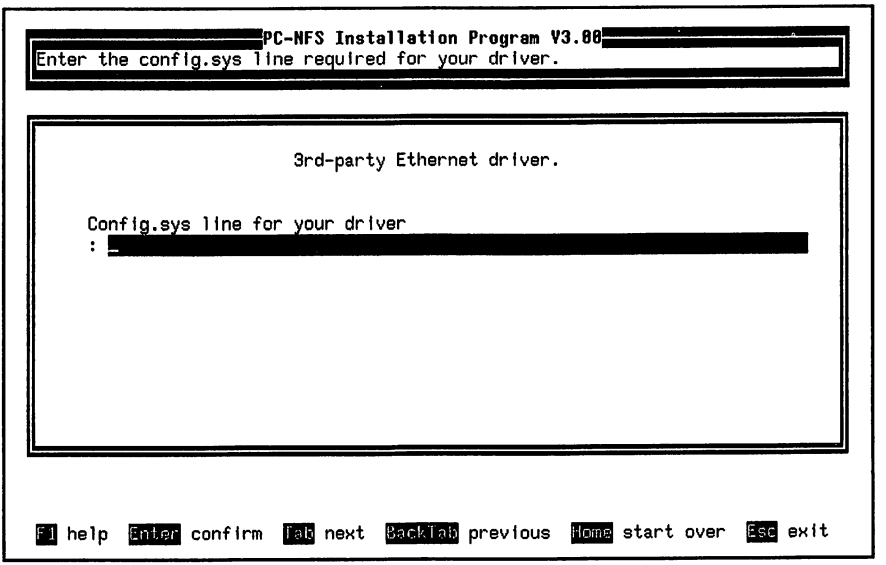
Connections Configuration

The next screen asks you to select either Ethernet or serial. Make the appropriate choice for your configuration. If you select serial, proceed to the section "Serial Installation."

Ethernet Installation. If you select Ethernet, the PC-NFS installation program displays a menu of network boards. Use the up and down arrow keys to highlight the board you are using for PC-NFS, and press Enter. If you do not know which network board you have, ask your system administrator.



If your board does not appear on the list, select `Other`. The following screen appears:.



The prompt is asking you to enter a line of the form:

`DEVICE` = *pathname*

that will be added to your CONFIG.SYS file. For the *pathname* portion of the entry, include the path for the device driver for your third-party Ethernet board.

For most network boards, the PC-NFS installation program asks you for an interrupt number and I/O port address. Use Tables 1-5 and 1-6 to help you with these values.

The default settings for these parameters are as follows:

Table 1-5 *Communications Network Board Default Parameters*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	3	300	----
3C503	3	300	----
3C505	3	300	----
NI5010	3	300	----
NIC	2		D000H
WD8003E	2	280	D000H

The following chart shows the acceptable ranges for these parameters:

Table 1-6 *Communications Network Board Parameter Ranges*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	2-7	200H-3F0H	----
3C503	2-5	250H-350H	----
3C505	3-7,9 (PC) 3-7,9-12,14,15 (AT)	200H-3F0H	----
NI5010	3 or 5	200H-3E0H	----
NIC	2-7	----	8000H-F800H (512K) - (992K)
WD8003E	2-7	200H-3E0H	8000H-F800H

In some cases the PC-NFS installation program asks you for a DMA Channel and Transceiver Type. Use the following table to help you determine these values. The transceiver values are thick and thin. The program accepts numeric values for this parameter, 1 for thin, 2 for thick. If you are unsure, use the default value for both parameters.

Table 1-7 *DMA Values and Transceiver Types*

Board	DMA Values	Default DMA Value	Default Transceiver Type
3C503	1, 2, 3	1	thin
3C505	0, 1, 3 (AT 8 bit) 5-7 (AT 16 bit)	1	

If you do not know how to answer any questions about your network connections, ask your system administrator for help.

Serial Installation. If you chose serial, the program asks whether you are directly connected or dialing up the server. Select either `direct` or `dial-up` as appropriate. The PC-NFS installation program then asks you for the communications port to be used (`COM1` or `COM2`) and for the baud rate (1200, 2400, 4800, or 9600).

Loading the Distribution Diskettes

Before beginning the actual installation, the PC-NFS installation program allows you to go back and change any of your responses. When you're ready to begin the actual installation, press Enter.

The PC-NFS installation program asks you to load the installation diskettes. When you have successfully loaded the installation diskettes, the PC-NFS installation program asks you if you are ready to continue. If you are, it starts the `nfsconf` program. If you are not ready to continue, press Esc to exit to DOS. If you do exit to DOS, however, note that your environment is in an inconsistent state, and you should run `nfsconf` and then reboot as soon as possible.

For the next step in the installation process, proceed to Chapter 2, "Configuring PC-NFS."

SunIPC Upgrade Installation

Your installation procedure differs slightly from a first-time installation since you have a previous version of PC-NFS on your system. You will see an additional screen after the copyright screen, asking:

```
Do you wish to do an upgrade (y/n)?
```

Your previously installed PC-NFS has a unique serial number. If you answer **Y** to this prompt you will retain your old serial number. If you answer **N**, you will get a new serial number when you install the upgrade.

The PC-NFS installation program uses the values from your current configuration as the default values. Pressing Enter for each of the questions in the installation process keeps your original configuration.

The rest of the procedure is identical to a first-time installation with the following exception. After you load all the diskettes, you do not have to configure PC-NFS, it uses your old configuration. You should reboot, to bring up the new version of PC-NFS. If you want to reconfigure any part of the program or mount new network disk or network printers, run the `nfsconf` program after you reboot. Follow the directions in the next section to install your upgrade.

For `Server`, enter the name of the system (Host Name) where the file system you want to mount resides. If you do not have Yellow Pages, you must also supply the Internet address for the server system. For `Path`, specify the complete path to the file system you want to mount. For the path, use the syntax of the network file server, for example:

UNIX	The path begins with a slash (/) and directory components are separated by slashes, for example, `/usr/tmp`.
VMS	The path may not include any slashes (/) or backslashes (\), for example, `dra:[xxx,yyy]zzz`.

The next item, `Options`, displays another pull down menu with these options:

- `No sharing control`
- `Read only access`
- `Use lock manager (if available)`
- `Use lock manager (required)`

Use the first choice, the default, if you want the files to have read and write file permissions. The second item sets read only file permissions. The third choice uses file locking to control use of the file by more than one user at a time, if your system has file locking. You can only use the last item if your network has the lock manager capability, otherwise you receive an error message and you must reselect. Note that PC-NFS only supports advisory file locking. For further information see Chapter 7, "*PC-NFS Technical Reference.*"

Each selection here creates a code for the resource display of the disk. The four codes for file access are:

–	No sharing control for files
`ro`	read only file access
`sh`	Use lock manager (if available) for files
`ms`	Use lock manager (required) for files

The last item, `Default for`, lets you make the current network disk the default mount for a selected DOS disk drive. If you select a network disk as the default, whenever you reboot the system that network disk will be mounted on the selected DOS disk drive. If you choose `None`, the disk drive will not boot with a default network disk mounted.

The Resource display screen appears with the network disk mounted. Press any key to continue.

Mounting Printers. If you select a DOS printer, the screen that appears has two parts, the `New printer` menu item, and the network printers in the resource pool. The cursor highlights `New printer` or the network resource currently mounted on the selected DOS printer. Select `New Printer` and press Enter if you want to mount a network printer (server, path name, and options) that you have not previously mounted. If you want to mount a network printer from the resource pool, use the cursor keys to highlight the printer you want. Pressing Enter mounts the highlighted network printer on the chosen DOS printer designation.

If you select `New printer`, a new menu appears with these six items.

- `Server`
- `IP address` (if your system does not have Yellow Pages)
- `Name`
- `Print Spooling Options`
- `Printer Mode`
- `Default for`

The last item, `Default for`, does not appear until you have completed the other items.

For `Server`, enter the name of the system (Host Name) where the printer you want to mount is attached. If you do not have Yellow Pages, you must also supply the Internet address for the system to which the printer is attached.

For `Name`, enter the name of the remote printer.

For `Print Spooling Options`, there are four options that determine when your output gets sent to the printer.

When you print from a DOS application, there is no software way to tell when the application has finished sending the file to the printer. With spooled printers, several users can send files to the printer at one time. The print jobs arriving at the print spooler form a queue. The files in the queue print in the order they arrived in the queue. If your application sends out pieces of your file at a time, the pieces could arrive in the queue broken up by other files sent by other users.

However, PC-NFS offers you four options to signal that the entire file is ready to be printed. Choose the option that works best for you:

`After 5 minutes`

If you choose `After 5 minutes` the print spooler works on a time out mechanism. When you select print your application sends data to the spooler. If your application sends nothing to the print spooler for five minutes, whatever has been sent to the printer is assumed to be the whole print job. If you have an application that produces a report in stages, and there may be five minutes of idle time, you should not choose this option because your report may get broken into more than one file. If you choose `After 5 minutes`, your output prints, after five minutes of inactivity, when your program exits, or when you use the PC-NFS `net print` command, whichever happens first.

`On program exit`

If you choose `On program exit`, PC-NFS sends your output to the printer when your program exits, or when you use `net print`, whichever comes first.

`Enable printer Hot key`

If you choose `Enable printer Hot key`, your PC-NFS sends your output to the printer when you press the printer Hot key, or when you use `net print`, whichever comes first. For more details see the section "Modify" later in this chapter.

There is only one printer Hot key. Once configured, pressing the printer Hot key sends output to all the printers for which you have enabled the printer Hot key.

`NET PRINT only`

If you choose `NET PRINT only`, PC-NFS sends your output to the printer only when you use the `net print` command.

The following table summarizes your options:

	Enables Printing			
Start Printer Spooling	After 5 Minutes	On Program Exit	On Hot key	Net Print
After 5 minutes	yes	yes	no	yes
On program exit	no	yes	no	yes
Enable printer Hot key	no	no	yes	yes
Net Print only	no	no	no	yes

The next item, `Printer mode` refers to the way in which the network printer sees your printer output. In most cases, the standard *pass-through mode* is the appropriate choice. Pass-through mode means that your application produces the output format that the printer expects.

For example, if your application produces PostScript output and your printer is a PostScript printer, select the pass-through mode because your application output matches what your printer expects to see. Likewise, if your application produces output for a Diablo 630 and you are printing on a Diablo 630, you should use pass-through mode; the application output matches what the printer expects to see.

If your application produces output for a Diablo 630 and you want to print it on a PostScript printer which supports Diablo 630 emulation, select Diablo 630 emulation mode.

If you choose Diablo 630 emulation, you must choose the printer pitch (10, 12, 15), the printer's normal font, and the printer's bold font.

Some applications produce PostScript output, but do not include PostScript headers. GEM is an example of such a program. If your application produces PostScript, but you have difficulty printing using pass-through mode, try specifying PostScript.

The last item, `Default for`, lets you make the current network printer, the default mount for a selected DOS printer. If you select a network printer as the default, whenever you reboot the system that printer is mounted as the selected DOS printer. If you choose `None`, the DOS printer will not boot with a default network printer mounted.

Each selection here creates a code for the resource display of the printer. The code for printers consists of a set of letters that specify information about the printer. The first letter tells you when print spooling occurs. The options are:

`y`	After five minutes
`n`	On program exit
`w`	Net print only
`k`	Enable printer Hot key

The second letter identifies the type of printer emulation. The options are:

`x`	Standard text
`p`	PostScript
`d`	Diablo 630

If the printer emulation is Diablo 630, letter code `d`, the column displays several other parameters. The next two characters tell the pitch, 10, 12, or 15. The next three characters tell you the normal font: The code for the fonts is:

`Courier`	`crn`
`Courier-Bold`	`crb`
`Courier-Oblique`	`con`
`Courier-BoldOblique`	`cob`
`Helvetica`	`hrn`
`Helvetica-Bold`	`hrb`
`Helvetica-Oblique`	`hon`
`Helvetica-BoldOblique`	`hob`
`Times-Roman`	`trn`
`Times-Bold`	`trb`
`Times-Italic`	`ton`
`Times-BoldItalic`	`tob`

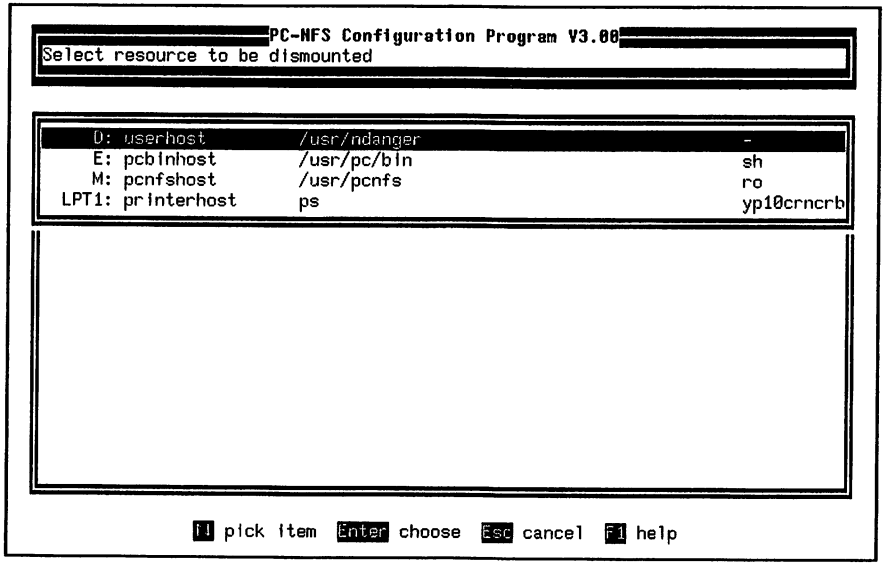
The next three letters describe the bold font, using the scheme above. For example, suppose you want to emulate a Diablo 630 using 10 pitch with Helvetica-Bold as the normal font and Courier-BoldOblique as the bold font printing `On program exit`. The coding that appears is:

```
nd10hrbcob
```

When you complete the mounting process, the Resource display screen appears with the network printer mounted. Press any key to continue.

Dismount

To dismount either a remote file system or printer, select `Dismount`. The following screen appears:



All the mounted network resources appear on this screen. Highlight the resource you want to dismount and press Enter. The Resource display screen appears with the resource dismounted. Press any key to continue.

The PC-NFS installation and configuration programs interact with the databases in Table 3-1. The installation program only affects the CONFIG.SYS and AUTOEXEC.BAT databases. Table 3-3 identifies the databases that configuration (nfsconf program) menu items interact with.

Table 3-3 *Configuration Database Interaction*

Database	Resources		Network		Connections
	Disks	Printers	Direct	Dial-up	
CONFIG.SYS			yes	yes	yes
AUTOEXEC.BAT			yes	yes	
NETWORK.BAT			yes		
DRIVES.BAT	yes	yes			
LPCNF0		yes			
LPCNF1		yes			
LPCNF2		yes			
LPCNF3		yes			
SLIPCONF.DB				yes	
HOSTS	yes	yes	yes		

The next several sections give more details about selected databases from Table 3-1 *PC-NFS Installation and Configuration Databases.*

CONFIG.SYS

If you are using PC-NFS with a serial adaptor, the installation program places the port and baud rate in this file.

This file also contains lines for several PC-NFS drivers. It always contains PCNFS.SYS and SOCKDRV.SYS. If you are using a serial board, the file contains the SLIP.SYS driver. If you are using an Ethernet board, it contains a *boarddriver*.SYS driver. If the Ethernet board is a 3COM board, there are other drivers in the CONFIG.SYS file.

Some configuration parameters cannot be set through the PC-NFS installation program. If you need to change these, use your favorite editor to edit this file. The tunable parameters are specified at the end of the lines:

```
DEVICE=C:\NFS\PCNFS.SYS
DEVICE=C:\NFS\3C501.SYS
```

Each option is given in the form /*<letter><integer>*. You must include a space before the first option and spaces between additional options.

You can use the following options for:

```
DEVICE=C:\NFS\PCNFS.SYS
```

`/f`*n* Set the maximum number of simultaneous open files to *n*. This must not be bigger than 127 or the results are unpredictable. The default value is 8.

`/i0` Disable incoming Internet datagram fragment reassembly. This saves about 4kb of memory. Unless you are working across an Internet router such as *SunLink-INR*™, this will not cause problems — PC-NFS never requests more data than will fit in a single Ethernet packet. Do **not** disable if you are using a serial port connection.

`/b`*n* Set the broadcast IP address to n, where n can be 0 (for all 0's, i.e. 128.15.0.0.) or n can be 1 (for all 1's, i.e. 128.15.255.255).

`/l`*n* Set the number of PC-NFS lock table entries to record all concurrently-active byte-range locks. The default is 16 entries. You should not specify more than 64 entries.

`/r`*n* Set the retry counter to *n*. This is the number of times PC-NFS will retry a request before giving the message "`Abort, Retry, Ignore?`" The default value is 4. A value of 0 means "retry indefinitely."

`/s` Enable space significance in file names. Do not use this switch if you run IBM PC-DOS. Use this switch for full compatibility with Compaq DOS 3.1 and other DOS versions.

`/t`*s* Increase the network time-out for utilities by *s* seconds. A value of 0 for *s* sets the value for infinite retries. If you ever get the DOS error "Not ready error reading drive," then try setting this network time-out for utilities to 0.

`/x` Configure PC-NFS for serial operations. This value is normally set by the PC-NFS `install` or `nfsconf` programs.

Different settings are available for these Ethernet communications boards. You can use the following options for:

```
DEVICE=C:\NFS\3C501.SYS
DEVICE=C:\NFS\NI5010.SYS
DEVICE=C:\NFS\NIC.SYS
DEVICE=C:\NFS\NFSVEC.SYS
```

`/i`*n* Set communications controller interrupt number to *n*, a number between 2 and 7. The default value is 3 for the 3C501, 3C503, and the NI5010 controllers, and 2 for the NIC controller.

`/m`*n* Set communications controller (NIC only) shared memory address to *n*, a five-digit hexadecimal number. The default value is D0000.

`/pn` Set communications controller (not valid for NIC) I/O port address to *n*, a three-digit hexadecimal number. The default value is 300.

Note that you can also set the values for `/in`, `/mn` and `/pn` by running the PC-NFS `install` program or `nfsconf`.

The 3C503 board has the following additional parameters:

`/dn` Set communications controller DMA value to *n*. The default value is 1.

`/tn` Set communications controller cable type to *n* which is either 1 or 2. A value of 1 is thin and a value of 2 is thick. The default value is 1.

AUTOEXEC.BAT

The installation program modifies your `AUTOEXEC.BAT` file so that PC-NFS starts up when your computer starts up (boots up). It adds the following lines:

```
SET TZ=xxxxxxx
SET NFSDRIVE=xx
PRT *
NFSRUN
```

The first line sets the time zone, the second sets the NFS drive where PC-NFS looks for its database files, the third starts the PC-NFS print redirector, and the last runs the network. If you are upgrading from a previous release, your network commands now reside in `NETWORK.BAT`. The `nfsrun` program runs commands from `NETWORK.BAT` and `DRIVES.BAT`.

The installation program also adds `\NFS` to your path or creates a path with `\NFS` if none exists.

Cautions. If you use environment commands, such as `path` or `set path`, they must appear in `AUTOEXEC.BAT`, not in `NETWORK.BAT`. If you have environment commands that refer to devices mounted by PC-NFS, these commands must follow the `nfsrun` command.

If you are upgrading, and have PC-NFS commands inside conditional statements in `AUTOEXEC.BAT`, you must manually alter `AUTOEXEC.BAT` for the new version. Otherwise, the PC-NFS install program moves all `net use` commands to `DRIVES.BAT` and the file listed in the next section to `NETWORK.BAT`. This may leave the `AUTOEXEC.BAT` file with incomplete conditional statements.

NETWORK.BAT

This database may include some or all of the following PC-NFS commands:

`NET YPDOMAIN`	Sets the Yellow Pages domain name
`NET START RDR`	Starts the network
`NET YPSET`	Sets the Yellow Pages server
`NET PCNFSD`	Sets the `pcnfsd` server
`NET ROUTE`	Sets the gateway system
`NET NAME`	Sets the user name
`NET SUBNET`	Sets the subnet mask

DRIVES.BAT

Contains `net use` commands that mount printers and drives.

LPCNF0, LPCNF1, LPCNF2, LPCNF3

These data bases contain printer configuration information and should not be modified by hand. Use the configuration program to make any changes.

SLIPCONF.DB

This file contains information about remote hosts you can dial up, including the dialog you use to connect to the host system if you are using a dial-up serial connection.

HOSTS

The `HOSTS` file contains server and Internet address pairs which are used if you do not have Yellow Pages.

Using Diskette-only System

On a diskette-based system, an NFS server can supply all the files you need during normal use. In most cases, PC-NFS supplies much faster disk access than diskettes on the PC itself. Therefore, you might want to arrange to use a PC-NFS disk as your "system" disk. To do so, you must set up a suitable disk configuration and then edit your `AUTOEXEC.BAT` file. The following steps illustrate this procedure. (These instructions assume that you have performed a diskette-only installation of PC-NFS as described in Chapter 1, and that you have booted up off this diskette in Drive `A`.)

1. Choose a directory in a suitable file system on your NFS server — for example, your home directory. The following example uses the directory `/usr/xyzzy` on server `adventure`.
2. Mount this using PC-NFS as follows:

```
A>net use s: \\adventure\usr\xyzzy
```

3. Create a new directory in this directory to use as your DOS system drive:

```
A>S:
S>MD DOS
S>CD DOS
```

4. Copy all of the necessary DOS and PC-NFS files to this new directory:

```
S>COPY A:\*.*
S>MD NFS
S>CD NFS
S>COPY A:\NFS\*.*
S>A:
A>net use S: /d
```

Note: You may wish to copy the remaining PC-NFS files from the installation diskettes to the `\NFS` directory. Remember that when you do a diskette-only installation, you only get a subset of the PC-NFS utilities. Similarly you may wish to install additional DOS utilities from your distribution diskettes.

5. Edit your `AUTOEXEC.BAT` file and append the following line before the `nfsrun` command:

```
SET NFSDRIVE=S
```

6. Edit your `AUTOEXEC.BAT` file and append the following lines after the `nfsrun` command:

```
net use s: \\adventure\usr\xyzzy\dos
SET PATH=S:\;S:\NFS
SET COMSPEC=S:\COMMAND.COM
S:
```

You need to modify the line `SET NFSDRIVE=S` to fit your system's configuration.

The `COMSPEC` variable tells DOS where to find `COMMAND.COM`, the DOS command processor. The `NFSDRIVE` variable tells PC-NFS where to find its message files, `HOSTS` file, configuration files, and others.

PC-NFS maintains a spool file "ready and waiting" whenever a printer is redirected. This might result in a number of zero-length files being left in the PC-NFS spool directories. You should add an entry to `/usr/lib/crontab` to clear these out at regular intervals; for example:

```
0 4 *** find /usr/tmp -atime +1 -type f -exec rm {} \;
```

Systems That Need to Run `pcnfsd`

You must run `pcnfsd` on every system that performs user authentication services and every system to which you want to spool print files. If you use Yellow Pages, you should run `pcnfsd` on all Yellow Pages server systems, master and slave alike. (Since PC-NFS can pick any of the Yellow Pages servers as the default server, a copy of `pcnfsd` must run on each server.)

If running `pcnfsd` on all Yellow Pages servers is impractical, add a `net pcnfsd` command to each PC's `AUTOEXEC.BAT` file to force PC-NFS to use a specific server.

Because `pcnfsd` simply invokes the standard print spooling subsystem, it can be used with remote printers. Say, for example, you have two network file servers:

- `diamond`, a Sun 3/170, and
- `emerald`, a DEC VAX™ running 4.2BSD UNIX with a printer named `dpp` available on it.

You can set up a `/etc/printcap` entry on `diamond` to read:

```
dpp:lp=:rm=emerald:sd=/usr/spool/dpp
```

PC-NFS clients can then use the printer `\\diamond\dpp`, and their print jobs will be routed to `emerald`.

You can use this capability to make printers accessible to PC-NFS clients even though the printers are attached to servers that are not running `pcnfsd`. Therefore, you don't have to port `pcnfsd` to systems in order to gain access to their locally attached printers.

Installing pcnfsd – The Procedure

Installing pcnfsd on a server is a relatively straightforward procedure. First, get PC-NFS up and running on a PC, then (using the nobody user privileges) transfer the pcnfsd file to the host. (On non-Sun systems, you then port the program.) Finally, you perform a few steps to get the daemon running. The basic flow of the procedure is the same for all systems, but some steps differ slightly depending on the server system, as noted below.

Sun provides two versions of pcnfsd. The standard version is started explicitly from etc/rc.local. The second version can be started by the inetd "superdaemon." If you wish to use the second version, read the source code and consult your server system documentation.

Use the following procedure to install pcnfsd:

1. Make sure that the file system containing /usr/tmp (or other selected spooling directory) is exported and has at least 100 Kb of free space on it.
2. With PC-NFS running on a PC within the network, place the distribution diskette containing pcnfsd (see *Read This First* for diskette listings) in the PC drive, and type the commands:

```
A>net use k: \\server\usr\tmp
A>COPY a:pcnfsd.* k:
A>COPY a:makefile k:
```

   where *server* is the name of the NFS server on which you want to install pcnfsd.

3. Log in to the NFS file server as superuser. Check that the directory /usr/local/src exists. Copy the source files into it:

```
% cp /usr/tmp/makefile /usr/local/src
% cp /usr/tmp/pcnfsd.c /usr/local/src
```

4. Now copy the pcnfsd binary file to /etc. This file is a Sun-2 binary version that will run on a Sun-3 in compatibility mode.

   For any other server, change the directory to /usr/local/src, build pcnfsd using the makefile supplied, and install it as below. See the section *Before You Port pcnfsd* later in this chapter.

5. Select a suitable location for the spool directories — for example, `/usr/tmp`. Make sure that the file system that contains this directory is exported, without any restrictions, by checking the contents of `/etc/exports`. Then add the following lines to an appropriate place in `/etc/rc.local`:

```
if [ -f /etc/pcnfsd ]; then
        /etc/pcnfsd /usr/tmp ; echo ' pcnfsd'   >/dev/console
fi
```

   A good place for this command sequence is immediately after the commands to start up `ypbind`.

6. Now start `pcnfsd` with the command:

```
% /etc/pcnfsd /usr/tmp
```

   You should return to the shell prompt with no error messages; this indicates that `pcnfsd` has configured itself and is running.

7. Check that `pcnfsd` is accessible via network RPC by typing on the PC:

```
A>rpcinfo -u localhost 150001 1
```

   to verify that the program is "ready and waiting.

Printer Configurations

Three basic printer configurations can be used with `pcnfsd`: line printer, serial printer, and laser writer printer. Each of these is described in turn below.

Line Printers. A standard line printer needs no special consideration. Since few PC applications include explicit provision for line printers, you should advise PC-NFS users that only basic ASCII files can be printed, and that they should leave their network printer configured in **pass-through** mode.

Serial Printers. If you have connected a serial printer to your system, PC applications might be able to make optimal use of it. To do so, they must be able to drive it directly.

Applications that run on UNIX systems rarely include sophisticated printer control. Many system administrators therefore install printer filters to convert selected printer codes into the correct format for their serial printer. Since PC applications, on the other hand, can usually generate the correct codes for the printer directly, you can modify your system to make the most of this. To do so, look at the `/etc/printcap` file on your system. If necessary, create an entry to allow unfiltered access to the printer. It is a good idea to provide an alias for the printer that tells the user what kind of printer it is.

For example, if you have an Epson FX-85 with serial adapter attached to `/dev/ttyb` as the only printer on server `sunbeam`, the `/etc/printcap` entry might read:

```
lp|epson-fx85:\
    :lp=/dev/ttyb:br#9600:\
    :sd=/usr/spool/lp:lf=/usr/spool/lp/log
```

The PC-NFS user could then add the line:

```
net use lpt1: \\sunbeam\epson-fx85
```

to the `AUTOEXEC.BAT` file and configure the application software as though an Epson FX-85 were directly connected to `lpt1`.

LaserWriter Printers. PC-NFS includes specific support for the Sun LaserWriter/PostScript combination. For this to operate correctly, you should ensure that the TRANSCRIPT software that accompanies the Sun LaserWriter printer has been installed according to the manual, and that the support programs are in `/usr/local/bin`. You should use the standard `/etc/printcap` entry.

Before You Port `pcnfsd`

Before porting `pcnfsd` to your environment, read the comments in the source code and consult your Sun Microsystems Customer Support representative to see if such a port has already been carried out. If you do an original port, send details of any adaptations to Sun. These may be folded into the source code and redistributed, which would make it easier for other users to port `pcnfsd` to their servers. If appropriate, Sun will consider posting the sources to "`mod.sources`" on the Usenet.

`pcnfsd` is structured as a simple RPC server daemon, using the highest level of RPC service calls. If the Sun RPC library has been ported to your system, `pcnfsd` might need no more than simple recompilation. If the Remote Procedure Call library is not part of your standard `libc` library, you should modify the `makefile` to search the appropriate libraries.

Certain aspects of `pcnfsd` must not be changed when you port it to a new system. You cannot modify the RPC/XDR structures, for instance, since they are hard-coded into PC-NFS on the client side. You can, however, modify the print spooling strategy (provided that the client interface remains the same). You might, for instance, prefer not to follow the subdirectory-per-client model, which was adopted to compensate for the absence of an *exclusive create* option in the NFS protocol. In practice, a single spool directory arrangement is probably adequate.

If you are running Adobe Systems TRANSCRIPT software for driving an Apple™ LaserWriter, you might need to adapt the specialized "start print" code for Diablo-630 emulation. (If disk space is particularly tight, you can modify this code to use pipes instead of a temporary file.)

Serial Server

This section discusses the use of PC-NFS on a computer which is connected to a remote system or network using an asynchronous serial link, whether hard-wired or dial-up. This technique is generally referred to as "SLIP" — Serial Line Internet Protocol — operation.

Hard Wired

A hard-wired link is essentially a single RS-232 cable connecting the PC to a server port. It is a relatively permanent, dedicated connection. This configuration treats the link as a "slow Ethernet;" most of the network configuration and management issues are handled as in the Ethernet case. On the server side the `slattach` program is run during start-up which specifies that the port is to be used to communicate with a specific SLIP node at a given speed; the PC does the same with a combination of `CONFIG.SYS` and `net` commands, and communication is established.

In this mode, PC-NFS SLIP is compatible with that distributed as part of the 4.3BSD Berkeley UNIX system. Performance at 9600 baud is generally acceptable, although instead of NFS file access you may wish to use TCP-based services (FTP, RCP, etc.) whose protocols are better-suited to the lower performance link.

Dial-up

Dial-up operation is a very different situation. Not only is a dial-in port a potential security "hole." It is also typically a shared resource, used for interactive UUCP and SLIP traffic in and out. Furthermore a number of different SLIP clients may be connected at different times through the same or different ports. Therefore there must be a technique for controlling access and dynamically establishing the network configuration.

The procedure (which is automated using the `connect` program on the PC) allows the user to dial up the gateway system, log in as a normal interactive user, and run the program `/etc/sunslip`. This program validates the request, passes back network configuration information to `connect`, and puts the line into SLIP mode. The PC user can then use PC-NFS network services over the link. When the user has finished, the `hangup` command breaks the connection, causing `sunslip` to reset the line ready for the next dial-in user. Compared with the direct connect case, there are several new configuration and management issues here. There is also a performance degradation when operating at 1200 or 2400 baud. You should use a high-speed error-correcting modem, if possible.

Warning

In many UNIX systems UDP checksum verification is disabled for performance reasons. On an Ethernet, this is not normally a problem. **Attempting to use UDP-based services — including NFS file access — over an error-prone link such as a dial-up line without UDP checksumming is almost certain to lead to data corruption.** Unless you are confident that your link is essentially error-free, you are advised to use only TCP-based services, including TELNET, FTP and PC-NFS LifeLine Mail and Backup. Sun Microsystems cannot be responsible for the consequences if you ignore this warning.

Setting up a SLIP server

The following procedure applies to a Sun-2 or Sun-3 running SunOS 3.0 or higher.

You will need to have at least one PC connected to your local Ethernet (or a SunIPC with a floppy disk drive). On PC-NFS distribution diskette SERVER 2 you will find a subdirectory `\serial` which contains two files, `makefile` and `slipdist.tar`. Using PC-NFS, copy these files to a suitable directory (e.g. `/usr/local`) on the server. (You must have at least 1MB of free space on this file system.) Log in to the server, use `su` to become super-user, and make the directory to which you copied the files the

SunOS Before 3.2

For servers running SunOS previous to release 3.2, install both the lock manager and the status monitor. You can find binary versions of both these programs on your PC-NFS installation diskettes.

1. Using PC-NFS, copy the files `r_lockd` and `r_statd` to the NFS server.

   For example, you might decide to mount file system `\\server_4\usr\tmp` on network drive `Q` and then copy the two files there. In that case, from the PC, type:

   ```
   C>net use q: \\server_4\usr\tmp
   C>COPY a:r_lockd q:
   C>COPY a:r_statd q:
   ```

2. Log in as SUPERUSER on the NFS server and install the two programs under their correct names:

   ```
   # mv /usr/tmp/r_lockd /etc/rpc.lockd
   # mv /usr/tmp/r_statd /etc/rpc.statd
   # chmod 0755 /etc/rpc.statd /etc/rpc.lockd
   ```

3. Edit the file `/etc/rc.local` to start the status monitor (`rpc.statd`) and the lock manager (`rpc.lockd`), in that order.

4. Start up the daemons and verify that they are running by typing:

   ```
   # /etc/rpc.statd
   # /etc/rpc.lockd
   # rpcinfo -u localhost 100021
   ```

If you want to monitor file sharing violations and help PC-NFS users with troubleshooting, invoke `rpc.lockd` with the option `-sl`. This generates a log of all file sharing violations that appears on the system console.

SunOS 3.2 and Higher

Servers running SunOS 3.2 normally run both the lock manager and status monitor programs. However, to support PC-NFS you must install a new version of the lock manager. You can find a binary version of this program on your PC-NFS distribution diskettes.

1. Using PC-NFS, copy the file `r_lockd` to the NFS server.

   For example, you might decide to mount file system `\\server_4\usr\tmp` on network drive `Q` and then copy the file there. In that case, from the PC, type:

   ```
   C>net use q: \\server_4\usr\tmp
   C>COPY a:r_lockd q:
   ```

2. Log in as `superuser` on the NFS server, terminate the old lock manager program and install the new one:

```
# ps ax | fgrep rpc.lockd
# kill -9 rpc.lockd's-pid
# mv /etc/rpc.lockd /etc/rpc.lockd.dist
# mv /usr/tmp/r_lockd /etc/rpc.lockd
# chmod 0755 /etc/rpc.lockd
```

3. Start up the new `rpc.lockd` daemon and verify that it is running by typing:

```
# /etc/rpc.lockd
# rpcinfo -u localhost 100021
```

If you want to monitor file sharing violations and help PC-NFS users with troubleshooting, invoke `rpc.lockd` with the option `-s1`. This generates a log of all file sharing violations that appears on the system console.

SunOS 4.0 and Higher

Servers running SunOS release 4.0 and higher already contain support for PC-NFS. Type:

```
# rpcinfo -u localhost 100021
```

If the procedure is `ready and waiting`, you're all set. Otherwise, follow the procedure described earlier for servers running SunOS 3.2.

Adding PC-NFS to your Sun Network

If you are adding PC-NFS to a Sun Network, use the following checklist to ensure you have made the appropriate changes to support PC-NFS.

1. You must add the PC host name to the `/etc/hosts` file of any host system you want to access from PC-NFS. If you have Yellow Pages, you need only add the PC host name to the `/etc/hosts` file on the Yellow Pages server.
2. If the PC-NFS user is new to the network, add the user name to the `/etc/passwd` file of any host system you want to access from PC-NFS. If you have Yellow Pages, you need only add the user name to the `/etc/passwd` file on the Yellow Pages server.
3. If the PC-NFS user is new to the network, you must create a home directory and set up a `.login` file.

- Verify that the communications board is functioning properly by using the diagnostic program supplied by Sun or the board manufacturer. Be sure to disable PC-NFS before using a controller diagnostic program, as the two programs would conflict and produce unpredictable results if run together. Follow the instructions given in the section *"Disabling PC-NFS."*
- Make sure that your communications controller is correctly configured. Your controller should have all jumpers set for its default configuration (except for the Leading Edge Model D, or if you've configured to use a different interrupt number). Refer to the installation manual for the controller you are using for more information.

  If your PC is a Leading Edge Model D and you are using one of the 3Com 3C501, 3C503, 3C505, or Micom-Interlan NI5010 controller cards, the I/O base memory address jumpers and the I/O port address (use `nfsconf`) must be set to a value other than "300." A good alternative value is "330." Check the manuals of the other hardware cards you may have added to your PC to ensure that no other hardware has the same address as your communications controller.

Try Disabling PC-NFS

Try running your application without PC-NFS in the system to verify that the application runs properly on a non-networked DOS. To do this, rename the `CONFIG.SYS` and `AUTOEXEC.BAT` files in your root directory to some other name (such as `CONFIG.NFS` and `AUTOEXEC.NFS`) and reboot the system. By renaming these files and rebooting the system, you have disabled the automatic loading of the PC-NFS drivers into the system. See the section *"Disabling PC-NFS"* below.

If after removing PC-NFS from the system the application still experiences problems, then the problem is probably not caused by PC-NFS. Consult the documentation for the application that is causing the problem. To re-enable PC-NFS, change the `AUTOEXEC.BAT` and `CONFIG.SYS` file names back to their original form. See the section *"Re-installing PC-NFS"* below.

Disabling PC-NFS. If you want to de-install PC-NFS, you can use the following sequence. Change directory to the root of the disk from which you boot and type:

```
C>DIR *.OLD
   (verify that AUTOEXEC.OLD and CONFIG.OLD exist)
C>RENAME AUTOEXEC.BAT AUTOEXEC.NFS
C>RENAME CONFIG.SYS CONFIG.NFS
C>COPY AUTOEXEC.OLD AUTOEXEC.BAT
C>COPY CONFIG.OLD CONFIG.SYS
C>REBOOT
```

If you have upgraded or installed the software more than once, `AUTOEXEC.OLD` may contain the following that you must delete from the file:

- `net` <command>
- `NFSSERVER`
- `PRT *`

The `CONFIG.OLD` may contain the following that you must delete from the file:

- `PCNFS.SYS`
- `SOCKDRV.SYS`
- (board_type)`.SYS`

Re-installing PC-NFS. The installation program allows you to re-install even though PC-NFS has been installed before. It assumes that the DOS system file `ANSI.SYS` is in the root or wherever it is specified in `CONFIG.SYS`.

If you run the PC-NFS `install` program on a PC that already has PC-NFS installed, the configuration does not necessarily change. All the PC-NFS files are copied over, although all your configuration files are saved. Unless you specifically ask it not to, you get a new serial number. You might do this, for instance, if you moved your PC from one network to another.

PC-NFS License Violation Detection

A PC-NFS license violation occurs when multiple copies of a single licensed copy of PC-NFS software are present on a network. Under PC-NFS licensing restrictions, each copy of PC-NFS is for a single user only. It is not to be shared. PC-NFS does not use a copy protection scheme. This means that you

then possibly the network is disabled for that system. Refer to the manual *Networking on the Sun Workstation* to verify proper network operation.

Check Network Connectivity

Duplicate Internet addresses confuse network software. The PC-NFS software can detect duplicate Internet addresses only on other PCs running PC-NFS on the network. Use the `arp` command to inspect Internet addresses. If you detect a duplicate, inform your network manager.

PC-NFS does not include the UNIX `ping` utility. The `nfsping` utility is analogous, but works at a higher level: it verifies that PC-NFS can talk via RPC to the `mounted` daemon on the server. PC-NFS does, however, respond to ICMP echo requests. You can therefore use `ping(8)` from a SunOS server to verify network connectivity. If the PC does not respond to the `ping`, run the `netstat` utility on the PC while using the `ping` command. This displays the count of ICMP requests received by the PC.

If the count does not increment, the PC physical connection may be faulty or the network may have failed. If the ICMP message count *does* increment, you may want to use `etherfind(8)` or `traffic(8)` on a different SunOS server to see if the ICMP responses are getting out to the network or if the transmit side of the PC network interface has failed.

Trailer-Encapsulated Packets Not Supported

PC-NFS does *not* support the use of 4.2BSD "trailer-encapsulated" Ethernet packets. If PC-NFS appears to work except for operations that read large chunks of data, you should run the `ifconfig(8)` program on the server to determine whether trailers are turned on.

Routing Through Gateways

PC-NFS incorporates a very simple routing strategy. All Internet datagrams targeted at networks other than the local net are forwarded to the gateway system selected by the `net route` command at `PC-NFS` start-up. If no gateway has been designated, the datagram is not sent. The number of datagram transmissions that fail in this way is displayed by the `netstat` command. If a server is moved from the local network to a network that must be reached in one or more hops, you must ensure that a gateway PC is known to PC-NFS. This happens automatically if Yellow Pages are used. If you are not using Yellow Pages, you can specify a gateway machine using the advanced questions screen of the `Network Direct` configuration screen of the `nfsconf` screen. A gateway is not needed for dial-up serial operation.

Limitations on Gateways

PC-NFS cannot handle multiple gateways, and does not respond to ICMP "Network Unreachable" or similar control messages.

General PC Application Problems

This section deals with problems which may affect application programs generally. Sun has tested many of the popular PC applications and utilities with PC-NFS. Many special considerations, restrictions, or incompatibilities are noted in Chapter 6, *Application Notes.*

PC Application Performance

Now that your PC is part of a network, you have convenient access to remote files and peripherals. However, you no longer have *exclusive* access to the resources that your PC applications use. For example, one of your PC applications might use a database that resides on the disk of an NFS server. This database might also serve PC applications that belong to other network users.

Under PC-NFS, PC application performance can vary for the following reasons:

- Another user or system program might be using a network resource that your PC application needs. This is called *resource contention.*
- It might take the network some time to respond to your PC application's request for services. This is called *network latency.*

Except under unusual conditions, PC application performance differences under PC-NFS should be minimal. If you experience a more serious deterioration in PC application performance, the network manager may be able to make adjustments on the network that improve your PC application's access to necessary resources.

Check For Special Requirements

Verify that your application is not performing operations that would interfere with PC-NFS operation. A few of these operations are listed below.

1. The application disables interrupts for an extended period of time. If `telnet` is running in the background, it needs to perform various interrupt- and clock-driven functions to keep your session alive.
2. The application is "stealing" the Real Time Clock interrupt and not passing the interrupt along.

`JOIN`	Connects a disk drive to a directory on a different drive. This is similar to the SunOS `mount` command. Use `net join` instead.
`LABEL`	Creates, changes, or deletes a volume label on a disk.
`RECOVER`	Recovers files from a disk that has defective sectors.
`SUBST`	DOS 3.1 SUBST causes a drive specification to refer to another drive. `SUBST` in DOS 3.2 works.
`SYS`	Transfers operating system files from one disk drive to another.

The commands and utilities listed above work only on local files and drives. When you work with files on a mounted file system, however, you are using a remote disk. The fact that you are using a remote disk is usually not apparent. However, you need to keep the distinction between physical and logical disks in mind when you attempt to:

- Physically alter the format or content of a diskette or hard disk, or
- Use DOS commands that duplicate PC-NFS services.

Note that you *can* store and run these programs on a remote NFS disk, but they can only operate on local DOS disks.

Check for Name Mapping Problems

If you suspect that the trouble is with file names that are translated by PC-NFS, refer to the discussion of file name mapping in the *PC-NFS User's Manual*. Use the `ls` command to inspect the file names, and `mv` command to change file names that may be a source of trouble.

Illegal Names That Pass PC-NFS. PC-NFS allows you to create certain DOS-illegal names without error, provided that the application does not check the name syntax. However, if the name is ever displayed as part of a directory listing, PC-NFS maps it as usual.

Avoid Using Mapped Names. The mapped file names that PC-NFS creates are temporary *handles* used only by PC-NFS. Name mapping does not necessarily produce the same result each time. Therefore, you should not build mapped names into your applications. At any point in time, PC-NFS commands can show you which mapping is in effect.

The "Name Cache". PC-NFS only keeps track of the mappings of the last 64 names it has processed. It does this by placing the mappings in the *name cache*. This can affect programs that read directory structures and retain the names for later use. For example, some file and disk maintenance programs might display a mapped file name on a networked file structure, and then not allow you to access the file. This happens because 64 new mappings were created by PC-NFS after the name you want was placed in the name cache. Xtree™ by Executive Systems Inc. and GEM Desktop by Digital Research are two such programs.

If you suspect that name mapping is causing a problem, rename the files to fit the DOS limitation of 8 character names and 3 character extensions. Use the *mv* command to rename the file as described in the Command Reference chapter in the *PC-NFS User's Manual*. Then retry the application. Also keep in mind that PC-NFS only processes names that are fewer than 64 characters in length. If you have a file with a name more than 64 characters in length, rename the file.

Converting Files – `dos2unix` and `unix2dos`. If you are transferring files between your PC and a server, you may find that some files display differently than they print, or display differently when stored on different file systems. This problem most often occurs with files created with a DOS program, and sent to a server via `telnet` to be printed. For example, programs like Wordstar set the most significant bit of some characters. This does not affect the way they look on the screen as displayed by `telnet`, but does affect some printers.

This type of problem can usually be fixed by using the `dos2unix` and `unix2dos` programs. These two utilities are described in the *PC-NFS User's Manual*.

Invisible Files. If you use `chmod` to deny yourself both read and execute permissions, you are no longer be able to access the file from DOS (or even see it in directory listings). However, you can still log in to your server system (with `telnet`) and change the file permission to make the file readable.

Superuser for Fixing Problems. On most NFS server systems there is a special user named "root" or "superuser." This superuser can change any user's file attributes. If you have problems with file attributes, such as permissions or groups, as system administrator you may be able to solve the problems while logged in as superuser.

Permissions: Special Considerations

Many DOS commands and utilities expect to encounter files for which read access is permitted. If read access is *not* permitted, the resulting error message may be confusing or misleading. For example, if a program attempts to open an unreadable file, the message "`file not found`" may be displayed, even though the file does exist. Another possibly confusing error message that can occur if you attempt to create a file within an improperly protected directory is "`file creation error.`"

File Locking Problems

Each section below details a different problem with file locking.

Check For Simultaneous File Access

If the program you are trying to use is having problems with data files on the server, make sure that no one else is trying to access the same file at the same time. If file locking is not in operation, two programs on different PCs could possibly access and change the same file at the same time. A file can become corrupted if two systems or programs write to a file at the same time.

Using `/MUSTSHARE` prevents all access to the drive if the File Locking Services detect a Lock Manager failure.

If Your Server Crashes

PC-NFS File Locking Services cannot detect server crashes and do not recover file locks when a server comes back up. Instead, the File Locking Services attempt to handle server crashes in a manner consistent with DOS 3.1 semantics. Generally, when a server crashes, the network reports an error to the PC application when it makes its next network request.

If Your PC Crashes

If your PC crashes while you have files open on a network drive that enforces locking, your file sharing and byte-range locks remain active. After a PC crash you must boot your PC and re-mount any network drives. When you do this, the Lock Manager program clears out any old locks.

Network Applications - rsh and telnet

Each section below details a different problem with either rsh or telnet.

telnet Problems

If you are using your application while telnet is active in the background, try using it without telnet resident. telnet does require memory from your PC and does require the use of the PC's real time clock even when it is in the background. This might interfere with your application.

Caution on Background telnet. When you use telnet to establish a connection to a server over the Ethernet, the server periodically sends messages to the client to make sure that the client is still alive. These messages are referred to as *keepalive* messages. They must be answered by the client even when telnet is in the background. If you are running an application that does not allow interrupts, telnet is not able to answer the keepalive messages. If this continues for about 2 minutes, the network breaks the telnet connection. Therefore, you should save as much of your work as possible before putting telnet in the background. Note that telnet cannot respond to keepalive messages when the message:

```
Abort, Retry, or Ignore?
```

appears on your screen and the system waits for a user response. Similarly, telnet cannot respond to keepalive messages when a license violation has been detected and the system waits for the user to depress the Alt key to continue.

Caution on Background telnet after Escape. Do not place telnet in the background after you have started it by escaping to COMMAND.COM from another application (such as, from Lotus 1-2-3). If you place telnet in the background this way, the system crashes.

Graphics Modes and telnet. If you use the Hot key feature to activate a resident telnet session while executing a DOS application in graphics mode, the application screen image is lost. When telnet returns control to the application, the screen is blank, but in the correct mode. telnet was designed to save only the character screen. The size of the buffer needed to save a graphics screen image is prohibitive for a program that loads and stays resident. Consult the documentation for your application to determine the correct way of redrawing the graphics screen image.

Files Not Printing Correctly

If your files do not seem to be printing properly try one of the following remedies:

1. If files created with a DOS program display, but do not print correctly when using `telnet`, use the `dos2unix` program to translate the files to UNIX format before printing. Programs like Wordstar set the most significant bit of some characters. This does not affect the way they look on the screen as displayed by `telnet`, but does affect some printers.
2. If text runs off the top or bottom of the page, try using a *formfeed* between pages instead of spacing with *line feeds*.
3. For some applications you may need to split the file into two or more parts before printing it.

See the chapter "Using Printers" of the *PC-NFS User's Manual* for further information on printer use.

Printer's Output Already Redirected

In some cases, PC applications are tied to a particular printer (typically `LPT1`.) Since the `net use` command requires that the output for *printdevice* is not already redirected, you might sometimes need to cancel a previous redirection.

There are two ways to accomplish this. The first is to use the `Resources` menu item of the `nfsconf` program. See Chapter 2 of this book for details.

You can also use the following command line to cancel the redirection of a printer's output:

```
C>net use printdevice: /d
```

If *printdevice* is not currently redirected, PC-NFS displays an NFS system message and ignores the request.

Read the rest of this section only if:

1. You have access to an NFS print server with an attached Sun LaserWriter, or
2. You need to change the default print initiation mode.

LaserWriter Problems

LaserWriter as a PostScript Printer. If you have a PC application that can generate PostScript commands, you can use a remote LaserWriter printer.

You should be aware, however, that some applications (for example, early versions of Digital Research's GEM) omit important PostScript control information. To compensate for these omissions, select PostScript mode when you configure your printer.

LaserWriter as Diablo-630. **Note**: Due to a problem with the `ps630` utility in release 1.0 of the TRANSCRIPT software, the `pcnfsd` daemon software is shipped with the font and pitch selection features disabled. You have the problem if the message "`NN is not a valid pitch, 10 will be used`" (where NN is pitch setting) appears at the `pcnfsd` daemon console. Sometimes this error hangs `pcnfsd`.

The `ps630` problem is resolved in release 2.0 of TRANSCRIPT. If you have release 2.0 of TRANSCRIPT installed at your site, you should ask your system administrator to rebuild `pcnfsd` from the source file supplied with PC-NFS, using a command of the following form:

```
#cc -O -o pcnfsd -DPS630_IS_FIXED pcnfsd.c
```

Then install the resulting `pcnfsd` binary on each print server as described in Chapter 4 — *NFS Server Issues.*

Printer Hot key Cautions

Note these problem areas when you consider configuring a hot key sequence.

1. Do not use a printer Hot key sequence if you are using Microsoft Windows or WordPerfect. These products filter keystrokes so results are unpredictable. Do not use a printer Hot key sequence with any product that filters keystrokes.
2. Likewise, do not use a printer Hot key sequence if you are using a SunIPC. Using a printer Hot key sequence causes delays in character echo on a SunIPC.

PC-NFS LifeLine Backup

If you have purchased *PC-NFS Lifeline*, you can find troubleshooting information for *PC-NFS LifeLine Backup* in the manual that comes with that package.

Application Notes

6

If you have a problem getting an application to work with PC-NFS, this chapter might offer a solution or some helpful advice. If your problem is not mentioned here, try checking Chapter 5, *Troubleshooting PC-NFS*.

This chapter contains notes on the following applications:

`COMP.COM` in different DOS versions
The `DIR` command under DOS
1DIR™ from Bourbaki Incorporated
DESQview™ from QuarterDeck (Versions through 1.21)
Framework™ from Ashton-Tate
GEM (Version 1.2) from Digital Research
IBM FILEFAC and Excelerator
Microsoft Basic Interpreter (Version 3.0)
Microsoft Windows (Version 1.0)
Microsoft WORD® (Version 3.0)
MIT t-shell
MultiMate from MultiMate, International, an Ashton-Tate Company
Norton Utilities (Version 3.1)
Smartcom II® (Version 2.1) from Hayes
TREEd (public domain program)
WordPerfect (Version 4.1) from SSI Software
Wordstar™ (Version 3.21) from Micropro
Wordstar 2000 Plus (Version 1.01) from Micropro

COMP.COM in MS-DOS and PC-DOS

The file compare utility COMP.COM supplied with some MS-DOS implementations will display the message "Access denied" when both files or directories being compared are on PC-NFS networked drives. This problem does not exist with COMP.COM as supplied with IBM PC-DOS®. To see if you have the problem, try the following command:

C>**COMP** *n:file.ext n:file.ext*

where *n:* is any networked drive and *file.ext* is any file on the drive. If the compare is successful, then the problem does not exist with your version of MS-DOS. Your version of MS-DOS *does* have the problem if you receive an Access denied error.

To get around this problem, you can copy one of the files to a local drive before comparing them, or you can obtain a copy of IBM PC-DOS that does not have the problem. Unfortunately, PC-NFS cannot support both versions of COMP.COM simultaneously.

The DIR Command in DOS

The output from the DIR command under PC-NFS may differ from what you are used to. Under PC-NFS, the volume label field displayed by the DIR command identifies the network node whose disk contains your current directory.

Note that the disk free space values returned by the DIR command may not coincide with those from the UNIX df(1) command.

Finally, you might discover that you can't delete a directory, even though the DIR command display indicates that the directory is empty. This may be because the directory contains *hidden NFS files.*

DOS doesn't list these hidden files because the file name begins with a period. Under SunOS, such files do not normally appear in directory listings. PC-NFS reflects this by not displaying these NFS system files. You can make these files appear in a directory listing by using the PC-NFS command, ls -a.

Another reason you may not see files may be that the owner set the file permissions so that the files are unreadable by you. DOS doesn't treat files that you can't access as normal files.

1DIR from Bourbaki Incorporated

Bourbaki Incorporated's 1DIR™ *cannot* be used on network drives. Every line of the file window will show the volume label (i.e. the server name). The solution to this problem is being researched for a possible future release.

DESQview from QuarterDeck

If you try to run `telnet` under QuarterDeck's DESQview™, your system will hang. This is due to a bug in DESQview that prevents any program compiled with Microsoft C Version 3.0 from executing another program. The bug is known to exist in versions of DESQview through 1.21. A patch (too complex to be included here) has been developed for DESQview 1.21 and posted to `net.micro.pc` on the *UseNet*. You should check with QuarterDeck to see if your version of DESQview fixes the problem.

Due to the way DESQview handles the keyboard, you cannot start a `telnet` session, suspend it, start up DESQview, and then "Hot key" into `telnet`.

`ftp`, `rsh`, `rcp`, and `telnet` cannot be run from DESQview windows.

Framework from Ashton-Tate

Framework™ always sets the highest disk drive as the default drive in DOS. This setting can cause a problem because the highest drive might not be *mounted* by PC-NFS, though DOS recognizes the drive.

Framework documentation suggests a fix to avoid this problem. The user must edit the CONFIG.FW file that accompanies Framework. Specifically, the user must alter the DEFAULT_DRIVE line and change the value from 0 (zero) to an actual drive name, such as `C:`.

GEM (Version 1.2) from Digital Research

When you run Digital Research GEM™, you can print files on a Sun LaserWriter. Choose the *Apple LaserWriter* option when installing GEM and make sure that you run your configuration program and select *PostScript mode*. You can print many graphic images at once with GEM. While PC-NFS does support this, we recommend that you limit the number of graphic images spooled to the printer, because space may be limited on the print server.

The GEM driver does not generate completely correct PostScript. Configuring it to work with a redirected printer that you have set into PostScript mode works correctly. The GEM Output subsystem buffers a considerable amount of data internally, and if you do not disable printer time-outs or select manual print initiation, you may find output being split with unpredictable (and generally disastrous) results. For the above reasons do not accept the default printer mode. Instead select printing using "`net print`." In this mode, spooling will not be initiated until you exit from the GEM Output subsystem and type **`net print *`** to flush the buffer and queue the file on the remote printer..

IBM FILEFAC and Excelerator

If you use PC-NFS with Excelerator alone or with IBM's FILEFAC alone, there are no conflict problems. However, if you use all three programs simultaneously, you must use them in a particular order. PC-NFS must be loaded first. Then, you must load Excelerator, followed by FILEFAC.

Microsoft Basic Interpreter (Version 3.0)

If you are running Microsoft Interpreted Basic and you press Ctrl Break while PC-NFS is processing a remote file request, Basic reports a "`Device I/O Error`." This error message is merely a side effect of the way PC-NFS processes fatal error exceptions. Therefore, in spite of the message, pressing Ctrl Break halts the application correctly. From that point, you can use the Basic command `CONTINUE` to proceed normally.

Microsoft Windows (Version 1.0)

Installation

You cannot use the `SETUP` program supplied with Microsoft Windows to install Windows successfully on a networked drive. To install and use Windows on a networked drive:

1. Install the program on a local hard drive.
2. Copy the files from the local directory where you installed Windows to a directory on a remote (networked) drive.

Accessing Printers

Do not use a printer Hot key sequence if you are using Microsoft Windows. This product filters keystrokes so results are unpredictable.

Using `telnet` with Microsoft Windows

You can use `telnet` with Windows in two ways:

1. Start a `telnet` session before running Windows, then exit leaving `telnet` resident in memory. Later, you can reactivate the `telnet` session from within Windows or after you have exited Windows. Note that you cannot remove `telnet` from memory while Windows is active.
2. Start a `telnet` session from within Windows, then return to Windows leaving `telnet` resident in memory. You can reactivate the `telnet` session from within Windows at any time.

However, you should know that when you start `telnet` this way, you can't remove it from memory. In addition, when you exit from Windows, `telnet` *remains* in memory. This in turn causes DOS memory fragmentation, which greatly limits the space available for running applications.

Creating a Program Information File for `telnet`

Before running `telnet` under Windows, it is necessary to create a Program Information File (PIF) for `telnet`. From the initial Windows screen, do the following:

1. Double-click on the `PIF` directory to open it.
2. Double-click on the program `PIFEDIT.EXE`.
3. Verify that the cursor (the blinking vertical bar) is in the "`Program Name`" field.
4. Type *x*: **`\NFS\TELNET.EXE`** (replace *x* with your PC-NFS drive, such as **C**).
5. Point and click in the "`KB desired`" box. Use the BkSp key to remove the existing value and type **0**.
6. In the "`Directly Modifies`" section, select "`Screen`," "`Memory`" and "`Keyboard`." If you intend to use `telnet` over an asynchronous link, select "`COM1`" or "`COM2`" as appropriate.
7. In the section "`Program Switch`", select "`Prevent`."
8. Open the "`File`" menu and select "`Save`."
9. Exit from `PIFEDIT` by "Closing" it.

You can now run `telnet` by changing to the `\NFS` directory on your drive and double-clicking on `TELNET.PIF`. If `telnet` is not resident, you will see the usual start-up menus. If `telnet` is resident, the program asks you if you want to resume the session.

Restrictions

Due to restrictions in Windows, you cannot do the following:

1. Use the Hot key to re-enter `telnet`. You must use the `telnet` program to do this. (This is why you cannot remove `telnet` once you have loaded it under Windows.)
2. Specify a host name in the `Program Parameters` section of the PIF. Actually you can specify one, but Windows will convert the name to upper-case, which will usually result in failure. (Most host names are lower-case.) You should therefore leave the `Program Parameters` section of the PIF blank.
3. Change an existing session with Windows loaded. If you run `telnet` and see the menu:

   ```
   Do you want to resume the current session

     A. Yes - resume the current session
     B. No  - open a new session
   ```

   you should **not** select `B`. If you do, and you then select a host, you will see the error messages

   ```
   NFS079F : PC-NFS Network Library Error #2004
   NFS102W : host is not a valid hostname.
   ```

   You should then press any key (as requested) and select F10 to cancel. Your `telnet` session will still be active.

Creating a Program Information File for `ftp`, `rcp`, and `rsh`

The PC-NFS utilities `ftp`, `rcp`, and `rsh` modify memory. Therefore, to run any of these programs from Microsoft Windows, you need to indicate this in the Windows Program Information File. Follow the instructions in the previous section on "Creating a Program Information File for telnet." In the "`Directly Modifies`" section, select "`Memory`."

Microsoft Windows (Version 1.4)

The "MS-DOS Executive" window has the first few pixels on the left side of the display cut off if you have drives up through and including disk drive `S` in use.

Microsoft Windows (Version 2.0)

The display clipping in the "MS-DOS Executive" window bug has been fixed by Microsoft for Windows 2.0.

Microsoft WORD (Version 3.0)

If you want to use Microsoft WORD in PostScript mode, you cannot simply configure the program and redirect the printer to the Sun LaserWriter. WORD requires that you download a special interpreter into the LaserWriter. This special interpreter is incompatible with spooled use of the LaserWriter in a multiuser environment. One workaround is to instruct WORD to send its output to a file, *yourfile*, configure a printer in PostScript mode with the PC-NFS configuration program, and then type:

```
C>copy/b applaser.ini+yourfile somefile
C>net print somefile LPTn:
```

where the file `applaser.ini` is included on one of your WORD distribution diskettes. If you want to print in Landscape mode, use `appland.ini` instead.

MIT t-shell

When you use `telnet` to connect to a host running the MIT t-shell, some characters are lost or replaced by a bell character. This is because the t-shell uses Ctrl S for the search function. `telnet` (like many terminals) uses Ctrl S and Ctrl Q for flow control. You can, however, configure the t-shell to use some other character for the search function. You can also disable `telnet`'s use of Ctrl S and Ctrl Q by selecting the `Xoff` item on the `Change Parameters Menu` described earlier in this chapter.

MultiMate

If you load MultiMate into a subdirectory on a network disk and run it from there, the first screen is somewhat distorted.

Norton Utilities (Version 3.1)

Norton Utilities™ that attempt to perform physical disk reads do not work on networked drives. (*NU* is one such utility). Physical disk reads that fail produce the message "`Error 1`." Other Norton Utilities work fine.

Smartcom II (Version 2.1) from Hayes

Hayes Smartcom II supports logical disk drives up to the letter `P` only. You should therefore avoid accessing the spool drives (`T`, `U` and `V`) or assigning networked drives beyond `P` when running this application.

TREEd

The public domain program TREEd crashes the system when used with PC-NFS. This is due to a bug in TREEd. When it gets an error from a "4E" system call, it does not clean up the stack properly and branches to a random address, thus crashing the system.

WordPerfect (Version 4.1) from SSI Software

WordPerfect™ from SSI software may not work properly if you start the program from a directory other than the one in which it was installed. If you encounter an error trying to load WordPerfect, type in the full path to the `WP.EXE` file when WordPerfect prompts you. WordPerfect will then patch itself and work correctly.

When printing, WordPerfect may be used with the Diablo emulation mode. However if you select `Diablo 630 ECS` from the printer menu, problems may arise since the program occasionally generates unsupported command sequences. Selecting `Diablo 620` works better.

Wordstar (Version 3.21) from Micropro

If you plan to use Micropro Wordstar™ with a Sun LaserWriter, we recommend that you configure the program to use a Diablo 630 printer and then use the PC-NFS configuration program to set the network printer to Diablo 630 mode. Use form feeds instead of line feeds in documents that you plan to print on the LaserWriter.

Wordstar 2000 Plus (Version 1.01) from Micropro

Micropro Wordstar 2000 Plus™ requires more files than PC-NFS supports by default. You can change the maximum number of files that PC-NFS supports by adding the `/fn` switch after the `PCNFS.SYS` entry in your `CONFIG.SYS` file. In order to run Wordstar 2000 Plus properly, you must increase the maximum number of files to at least 20.

Table 7-2 *Typical Memory Map*

Address	Start of:
0000:0000	Interrupt vector table
0040:0000	ROM BIOS data area
0050:0000	DOS communications area
xxxx:0000	DOS system files
xxxx:0000	Device drivers, including `ANSI.SYS`, `PCNFS.SYS`, the Ethernet driver and `SOCKDRV.SYS`
xxxx:0000	`COMMAND.COM`
xxxx:0000	Resident programs, for example, Sidekick, Turbo Lightning™)
xxxx:0000	Application programs

`PCNFS.SYS` is approximately 75 Kbytes in size (after allocating buffer and cache structures at initialization time), while the board drivers, except for the 3C505 board, occupy less than 10 Kbytes. The 3C505 board driver occupies about 25 Kbytes. Note that correct operation of the PC-NFS support programs requires that the `ANSI.SYS` driver be installed.

The socket driver, `SOCKDRV.SYS` is about 1 Kbyte in size.

Communication Controller Parameters

When configuring your communication card, you must determine its I/O port address or shared memory address in order to determine its Ethernet address. The information needed depends on the type of controller, as follows:

Table 7-3 *Communications Controller Types*

I/O Port Address	Shared Memory Address	None
3C501	NIC	NIU
3C503		3C523
3C505		
NI5010		
WD8003E	WD8003E	

The following table shows the acceptable ranges for these parameters:

Table 7-4 *Communications Controller Parameter Ranges*

Board	Interrupt Number	I/O Port Address	Shared Memory Address
3C501	2-7	200H-3F0H	----
3C503	2-5	250H-350H	----
3C505	3-7,9 (PC) 3-7,9-12,14,15 (AT)	200H-3F0H	----
NI5010	3 or 5	200H-3E0H	----
NIC	2-7	----	8000H-F800H (512K) - (992K)
WD8003E	2-7	200H-3E0H	8000H-F800H

The following is a sample `/etc/printcap` file entry:

```
ep|epson|fx286:\
:lp=/dev/ttya:sd=/usr/spool/ep:br#9600:fs#06020:fc#0300:\
        :xs#040:lf=/usr/adm/epd.errs:
```

Networks

Internet Subnet Support

This section discusses PC-NFS support for Internet subnet addressing. *Subnetting* is a mechanism that makes more efficient use of the Internet addressing scheme. It was first introduced in the 4.3BSD Berkeley Unix release[1], and is now supported by several TCP/IP implementations, including SunOS from release 3.3 onward and PC-NFS Release 2.0 onward.

This section describes how Internet addressing works and what role subnetting plays. This section also includes a description of how subnetting fits in with PC-NFS. For specific information about the `net subnet` command, see the chapter "Commands Reference" in the *PC-NFS User's Manual.*

A Short Treatise on Internet Addressing

Every computer connected to a TCP/IP network is identified by its Internet address. (Note that a gateway system may have two or more addresses, each corresponding to a distinct network to which the gateway is connected.) This IP address is a 32-bit unsigned integer that is conventionally broken into four 8-bit fields (octets). The value of each field is given in decimal, as, for example:

`192.9.200.3`

There are three classes (formats) of Internet address: A, B and C. The format defines which octets in the address identify:

1. the network to which the computer is connected (the *network number*)
2. the particular machine on that network (the *host number*).

[1] Following a scheme described by Mogul and Postel in the DOD document RFC950.

The format is determined by the value of the first octet, as follows:

Class A: octet 1 is from 1 to 127:

network no.	host no.	host no.	host no.

Class B: octet 1 is from 128 to 191:

network no.	network no.	host no.	host no.

Class C: octet 1 is from 192 to 254:

network no.	network no.	network no.	host no.

For example:

64.0.1.63 is a class A address. The network number is **64.0.0.0** and the host number is **0.1.63**.

131.12.14.207 is a class B address. The network number is **131.12.0.0** and the host number is **14.207**.

193.17.63.12 is a class C address. The network number is **193.17.63.0** and the host number is **12**.

The problem with this addressing scheme is that small networks lead to wasted Internet addresses. Consider an organization with two small Ethernets, one with 6 nodes, the other with 12. These Ethernets are not expected to grow bigger. Assume that class B addressing is used, with network numbers **122.10.0.0** and **122.9.0.0**. Even allowing for the fact that host numbers **0.0** and **255.255** are illegal, there are still *131,050* unused — and unusable — addresses. With class A networks, the problem is much worse, and even class C networks are not immune.

Subnet addressing can remedy this situation. In a subnet scheme, the host number is split into two fields: the *subnet number* and *host-in-subnet number*. This split is defined by the subnet mask, a number that selects which bits in the Internet address comprise the network number and subnet number. Networks with the same network number but different subnet numbers are considered to be distinct networks.[2]

In the preceding example, we could specify that the third octet was to be the subnet number and call the two Ethernets **122.9.1.0** and **122.9.2.0**. This would use only one valuable class B network number.

---

[2] There are certain restrictions on this. In particular, all subnets of a specific network are normally connected to the outside world through a single gateway: outside that gateway the subnet structure is transparent. For more details consult RFC950.

NFS111F : chmod: invalid mode.

You issued the chmod command with incorrect syntax. Refer to the Commands Reference Chapter in the PC-NFS User's Guide for instructions on entering the correct chmod syntax.

NFS112F : **server** is not on the same network as **pc-name**.

You attempted to select a gateway that is not on the local network.

NFS113I : There is **no** YP server currently defined.

PC-NFS does not have the name of a Yellow Pages server (you have not issued the net ypset command), or the Yellow Pages server has been reset as a result of a net ypdomain domain-name command.

NFS114I : No subnet mask has been installed.

You issued a net subnet command to determine the current setting of the Internet subnet mask, but subnet operation has not been enabled.

NFS115I : The subnet mask is **ddd.ddd.ddd.ddd [0xXXXXXXXX]**. Using this mask the network number is **nnn.nnn.nnn.nnn**; the host number is **hhh.hhh.hhh.hhh**.

Either You issued a net subnet command to determine the subnet mask setting, or you successfully used the net subnet * command to obtain the mask from another host on the network. See the section on Internet Addressing in Chapter 7 of this manual.

NFS116W : Unable to obtain the subnet mask from any network server

You tried to obtain the Internet subnet mask from another host on the network using the net subnet * command, but received no reply. Check that your system is connected to the network and that a server or gateway machine is running.

NFS117F : **string** is not a valid controller type.

You specified an invalid controller type. Currently supported Ethernet controllers are 3C501, 3C502, 3C503, 3C523, NI5010, WD8003E, NIU, and NIC.

NFS118F : **string** is not a valid I/O port address or shared memory address.

You specified an invalid I/O port address or shared memory address. These addresses are configuration dependent. For specific parameter ranges and default parameters, see the Installing PC-NFS Chapter in this manual..

NFS119F : This command is not supported in this release of PC-NFS.

You tried to issue a net trace command. PC-NFS release 3.0 does not support the net trace command.

NFS120F : net use: x: is joined.

You tried to issue a net use command on a drive which was net joined. You may only use a net use on a unmounted, unjoined drive (letter). Issue a net use command to see what drive letters are in use.

NFS121F : Machine name `host name` is too long.

You tried to issue a net start rdr hostname command where host name has more than 15 characters.

NFS122F : Unable to delete host (ip addr) from ARP table.

PC-NFS is not able to delete host specified in arp -d host command from the arp table. Run ARP -d to verify that host is in the ARP table and that you spelled the name correctly.

NFS123F : Unable to empty ARP Table.

ARP -d * cannot empty ARP table. Try again. If that does not work, reboot and try again.

`install` Error Messages

The following error messages can occur while running the PC-NFS `install` program, or in the "Connections" section of the `nfsconf` program:

NFS124W : The DMA channel is not within the valid range of answers. Consult the PC-NFS User's Guide or the Help Screen to find the list of acceptable DMA channels.

NFS125W : The transceiver value must be a 1 or 2.
1 for thin cable (onboard transceiver)
2 for thick cable (external transceiver)

NFS126W : The I/O address base is not within the valid range of answers. Consult the PC-NFS User's Guide or the Help Screen to find the list of acceptable values.

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